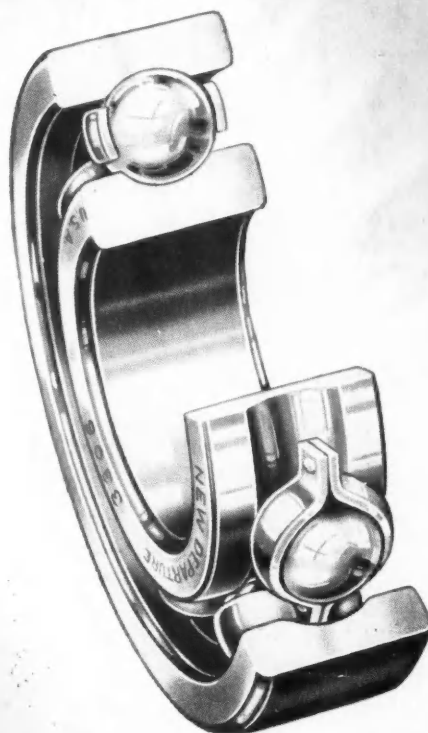


AUTOMOTIVE *and Aviation* INDUSTRIES

MAY 1, 1947

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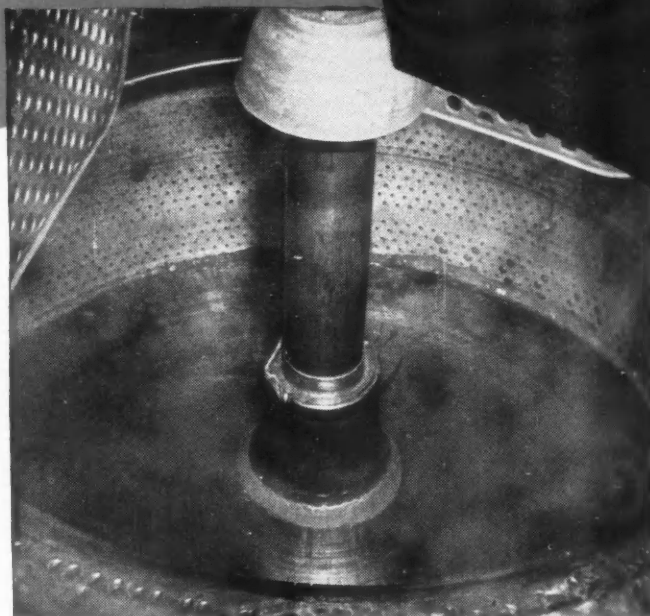
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Above—Shaft and bearing of the 60 inch centrifugal extractor pictured below, on which Stanodrip cut lubricant consumption in half and application time one fourth—a typical example of savings that may be uncovered by a Standard Oil Lubrication Survey



STANDARD OIL COMPANY (INDIANA)

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SERVICE**

AUTOMOTIVE and Aviation INDUSTRIES

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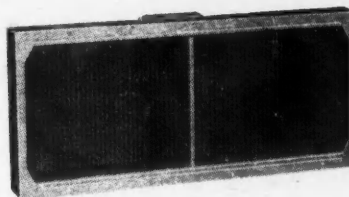
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May 1, 1947

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FOR ALL HYDRAULIC UNITS

Tune in . . . TEXACO STAR THEATRE presents the NEW TONY MARTIN SHOW every Sunday night. See newspaper for time and station.

Some High Spots of this Issue

Stress Analysis of Welded Torsion Bar Suspension

The torsion rod suspension system of a light, two-wheel trailer was analyzed and road tested to determine shear stresses in the torque rod under various conditions in order to predict the fatigue life of the system. Given Brewer describes the methods employed and the results of the tests beginning on page 24.

Kaiser-Frazer Production Innovations

An automatic machine capable of painting 1000 wheels per hour, a device at the end of the final assembly line that automatically raises an exhaust-gas deflecting plate for removing engine fumes, and a special three-way multiple drilling machine containing 63 spindles are among the innovations pictured and described on pages 28 and 29.

Newest Aeronautical Developments

Abstracts of important papers from the SAE National Aeronautical Meeting on such timely subjects as: Applications of hydraulics to rotary drives for aircraft accessories; installation engineering of turbo-jet engines; and the effect of C.A.R. requirements on airplane design will be found beginning on page 30.

Design Features of the New Packard Super-Eight Convertible

The new model features the Dura Hydro-Lectric system for power operation of windows, front seat and top, as well as an entirely new 145-hp engine. Major specifications and an excellent longitudinal sectional drawing of the engine are included in a description of Packard's latest offering starting on page 34.

A Spark Plug Pressure Indicator for Engine Testing

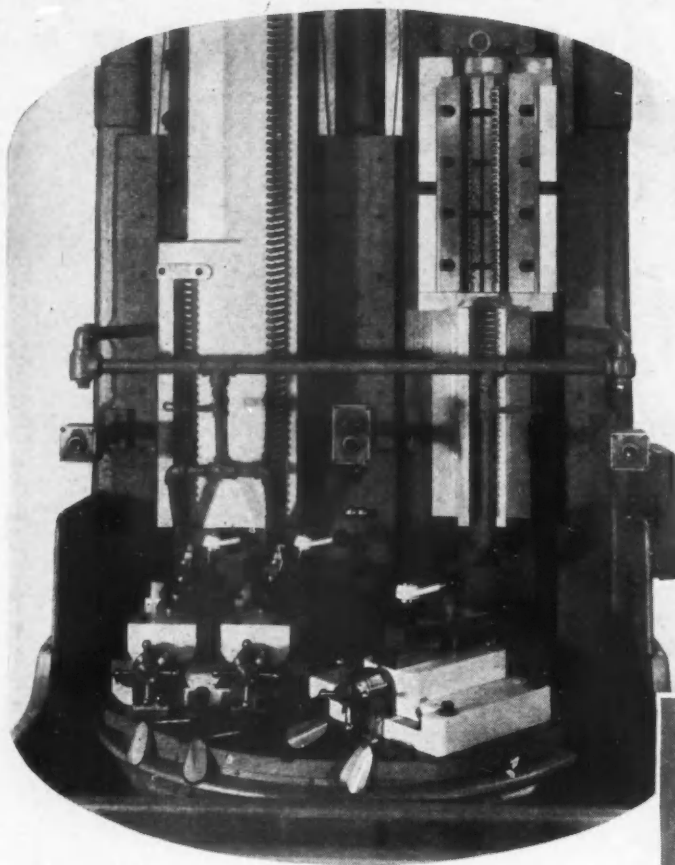
For easy installation when testing stock engines, a standard spark plug has been modified to contain an annular diaphragm, a crystal stack, and means for cooling. It is used in connection with an amplifier and an oscilloscope to obtain important pressure data. The new device is described and illustrated beginning on page 38.

The New GM Hydraulically Actuated Reverse Gear; 33 Items of New Products and New Production Equipment, And More High Spots Such As:

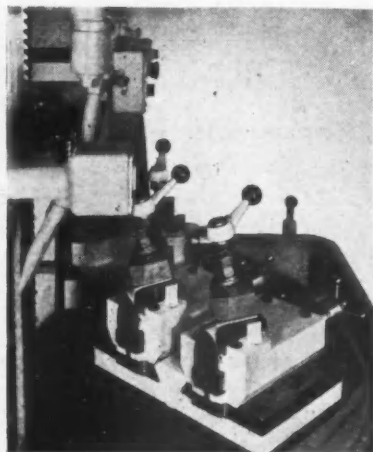
Lear Solves Short Run Problem; Unique Machine Tests Engine Mount Materials; and A Chronology of High Spots in the Life of Henry Ford.

Comprehensive Interpretation of Industry News, Page 17

For Complete Table of Contents See Page 3

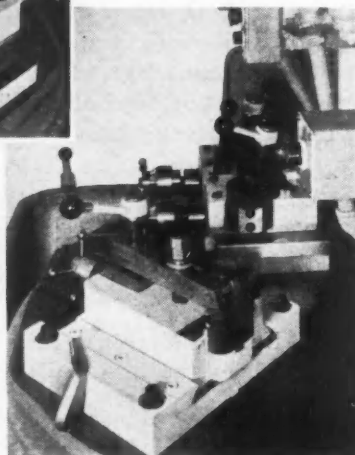


Above: CINCINNATI No. 10-66 Vertical Duplex Hydro-Broach, tooled up by CINCINNATI Engineers to broach golf club heads. Catalog M-1387-1 contains specifications of the Standard Duplex Machine.



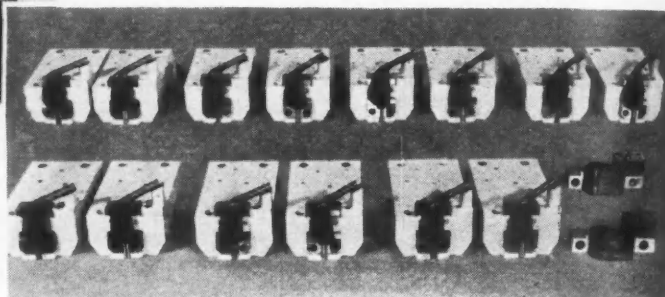
Left: Close-up of left hand fixtures, for broaching the groove and back of the club head.

Right: Close-up of right hand fixture, where the sole line, toe and heel of the club are broached.



How to play a stymie

... in manufacturing
golf clubs



These blocks are interchangeable in the fixtures for 11 different golf club heads broached on one machine.

• Maintaining accuracy of weight was a costly operation for a manufacturer of golfing equipment, so he turned to broaching as a means of raising quality standards and overcoming the stymie of high costs. ¶ Working in cooperation with the customer (MacGregor Golf, Inc.), Cincinnati Application Engineers devised the equipment illustrated here for a CINCINNATI No. 10-66 Vertical Duplex Broach, to broach club heads in three progressive stations. The degree of success created by this radical departure from established methods may be gaged from the weight tolerances which are now held for matched sets... within 1/16 ounce.

In two fixtures under the left hand ram, the back of the club head and a formed groove are broached. In the right hand fixture, the sole line, toe and heel of the club are broached. Production is over 100 club heads per hour complete

Perhaps many of the parts in your shop now being finished by other methods could be CINCINNATI broached more economically. Whether they weigh an ounce or two, or several hundred pounds, CINCINNATI Broach Engineers will be glad to work with you and devise equipment for broaching them faster and at lower costs.

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO, U. S. A.

MILLING MACHINES

• BROACHING MACHINES

• CUTTER SHARPENING MACHINES

NEWS *of the* Industry

Production Troubles Delay New Model Introduction

Production troubles which have hampered automobile output this year also are having their effect on preparatory work for introduction of 1948 models. One company that had planned to introduce its new model this summer has been forced to set the date back to October or November, according to one report. With the seller's market still holding firm for most companies the usual push from sales departments currently is lacking and there is no particular urgency to rush work on new models. It is believed, however, that if the market should sag unexpectedly during the next few months, new model work would be pushed vigorously in order to stimulate sales. During a spell of good weather in Detroit recently, the rush of new orders was marked. Companies in the lower priced lines particularly report that backlogs are increasing continually.

Few Suppliers Follow Car Makers' Lead in Price Cuts

When Ford Motor Co. and International Harvester Co. reduced prices earlier this year both requested suppliers to take similar steps wherever possible. The response is said to have brought about some price reductions, but not to any great degree. Chrysler Corp. also reports that some suppliers followed its plea for lower prices following a price reduction on Plymouth cars, but the amounts involved thus far are not enough to bring costs down significantly.

Government Increases Price Of Tin to 80 Cents a Pound

RFC has increased the price of tin to American buyers by 10 cents a pound bringing the metal up to 80 cents a pound. Reason for the increase is that the Government was required to boost its price to Bolivian producers by nine cents a pound this year. Between 10,000 to 12,000 tons

New models for 1948 held up . . . Manufacturers' Price Reductions Not Imitated by Suppliers . . . Ford Highland Park Expansion May Quickened Changeover . . . Detroit Talks Automatic Transmission . . . Ram Jets by Continental . . . Push Button "Screw Shift" Transmission by Wright . . . World Air Show at Philadelphia . . . Mathis Automobiles for America . . . Republic's Jet Ghost Plane . . . Martin XB-48, Six Jet Bomber Ready for Ground and Taxi Tests.

of tin come into the U. S. each year from Bolivia.

The automobile industry was greatly relieved to learn that the tin smelter owned by RFC at Texas City, Texas, was undamaged by the recent explosion and fire there. The smelting plant is the only one in the U. S. and the largest in the western hemisphere.

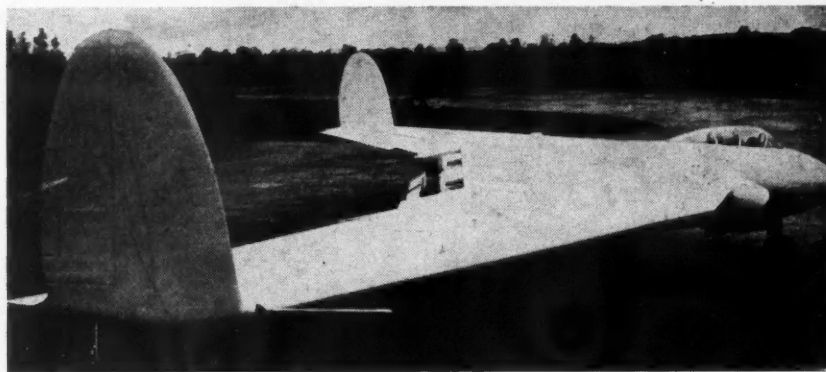
Ford Expands Highland Park —Shortens Changeover Time

Expansion of manufacturing facilities at the Highland Park plant is among Ford's production plans for 1948. Model changeover shutdown time will be shortened by the move of many manufacturing operations from Rouge to Highland Park. New machinery for 1948 manufacturing can be accommodated at Highland Park, permitting uninterrupted current operation at Rouge until changeover actually occurs.

Rear axle, rear axle assembly, propeller shafts, drive shafts, motor oil pan, front end suspension and fly wheel housing are among the activities scheduled to be moved. Gas tank, running board operations, and, if space is available, axle shaft machining may be moved.

However, this may be a tip-off that Ford is not planning introduction of 1948 models until very late this year or sometime next year. It is hard to see how the equipment could be installed and functioning in time to be of any help during the changeover period before December at least, particularly inasmuch as

Britain's First Jet-Propelled Wing



Soon to be test flown is this Armstrong Whitworth A.W. 52, Britain's first jet-propelled flying wing. Two Rolls-Royce Derwent turbo-jet engines power the A.W. 52 which has a span of 90 ft and is a true all-wing design except for wing-tip rudders, windscreen assembly and a slight bulge underneath. British Information Services photo.

NEWS of the INDUSTRY

actual installation of the new machinery at Highland Park is not scheduled to start until the end of September.

Automatic Transmission Talk Rife in Detroit

Automatic transmissions remain the hottest item in automotive development talk in Detroit today. One report is that one of the Big Three might come out with an automatic transmission on its 1948 model as standard equipment. Considering the cost and production difficulties, however, this report should be viewed with some skepticism. Nevertheless, it is known that one of the companies has several cars on test with a new type automatic transmission and that reports on its performance thus far are very optimistic.

Continental Works on Ram Jets

Ram jet engines which will develop the equivalent of 350,000 hp will drive pilotless planes three times the speed of sound in the not too distant future according to C. J. Reese, president, Continental Motors Corp. The conventional liquid-cooled engines that power trucks and

buses today will be replaced by air-cooled engines within five years, he also believes.

Pulse jet engines, gas turbine projects, compound engines combining gas turbine and piston engine principles, and light weight helicopter engines are among Continental's current projects, in addition to its development of ram jets and air-cooled engines. Continental is now working with the Army Air Forces on ram jet engines to operate guided missile aircraft at supersonic speeds.

Wright Announces New Transmission

A new type of transmission, known as the "screw shift" type, has been announced by the Wright Aeronautical Corp. It is readily adaptable to push-button control and will be available for use in buses, passenger cars, trucks, marine installations, and power plants.

The Wright transmission may be shifted under any condition of speed or load without temporary loss of power. Its mechanism automatically synchronizes gears before each shift. All shifting is done in a straight forward or reverse motion. Selector gears are moved forward or backward along helical splines on the main shaft until they synchronize

with the desired gear. This action is said to provide uninterrupted power to the drive shaft during shifting.

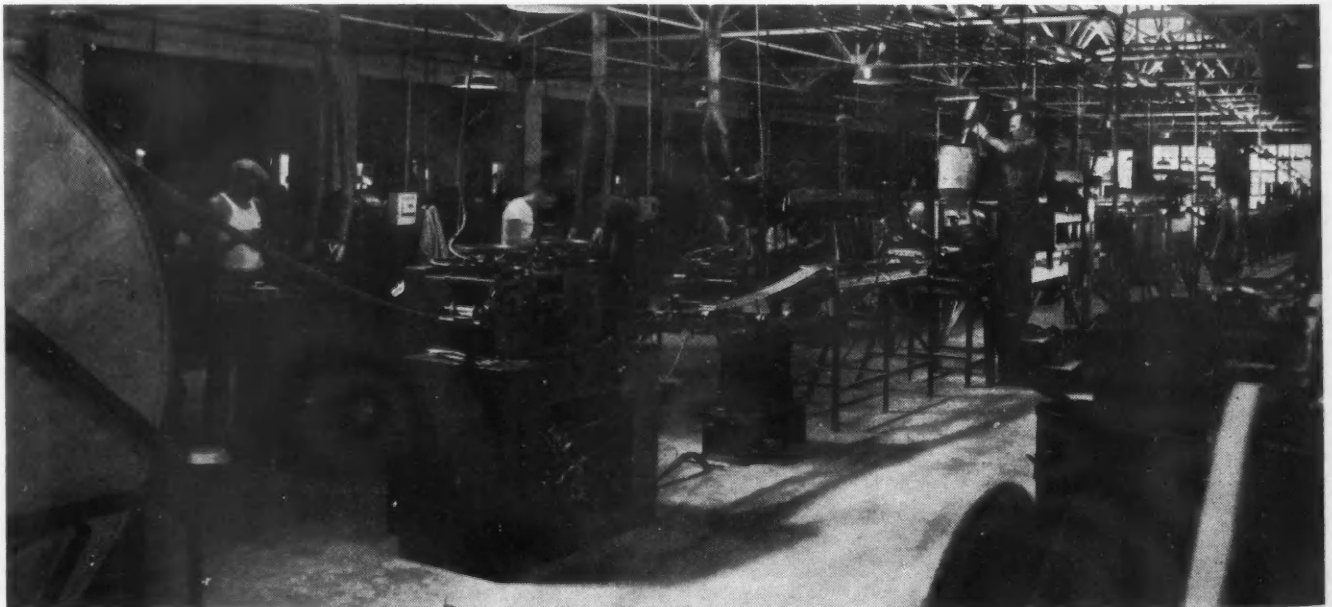
Aviation's Newest at Philadelphia Air Show

The Philadelphia World Air Show which is to be held at Northeast Airport May 30 through June 1 will dramatize air progress through the flight performances of jet planes, advanced helicopter types, latest model transport planes, reciprocating engine driven fighters and bombers, new cargo aircraft, and many types of personal and executive planes. The Army Air Forces, Navy and Marine Corps, airplane, airline, and helicopter manufacturers are all participating in the show.

1948 Plymouth May Have Bonded Brake Linings

It looks now as though Plymouth is planning to use bonded brake linings in the near future—possibly on its 1948 model. The company has installed special heating equipment which will bring the shoes quickly and uniformly to the temperature required in the bonding process.

Sintered Bearings by the Strip Method

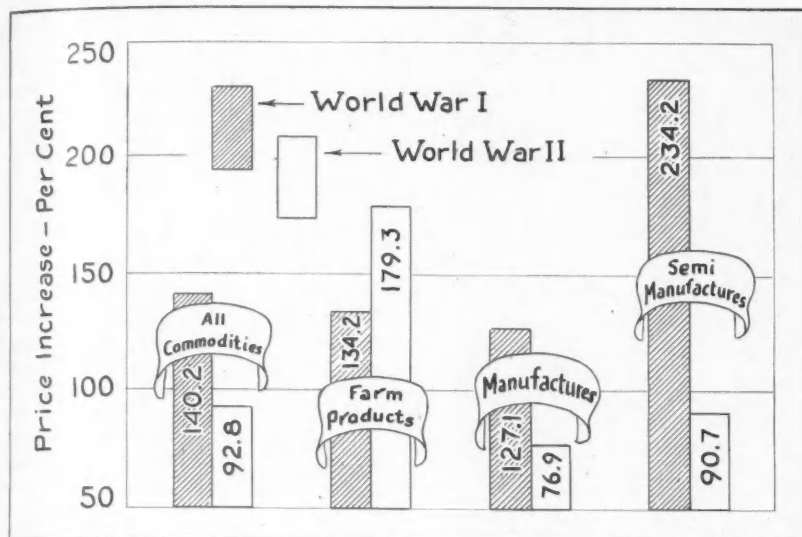


The continuous strip mill process is being used by Federal-Mogul Corp's Greenville, Mich. plant in producing the Federal-Mogul H-24, steel back, precision type, sintered copper-lead bearing which is being

used for the main and connecting rod bearings of the 1948 Packard Super-Eight engine. An impressive feature of this copper-lead alloy bearing is that the lead content may be varied up to 45 per cent.

NEWS of the INDUSTRY

Price Rises in World War I and II and Postwar



1926 = 100

The average price increases for the war periods shown include postwar periods of 18 months; thus, World War I is from August, 1914 to May, 1920; World War II is from August, 1939 to February, 1947. After World War I prices of all commodities reached a peak in May, 1920 and then weakened. In the World War II period, only the prices of farm products exceeded World War I average price increases. Source: National Industrial Conference Board.

Mathis Plans Cars for USA

The latest plans of E. C. Mathis for the production of a car for the American market include a model to be called the 666: six cylinders; 66 bhp, and 660 kg in weight. A speed of 93 mph is expected. A 444 model is also being planned: four cylinders; 44 bhp, and an expected gasoline consumption of four liters per 100 km.

Reports from France indicate that it is unlikely that Mathis' three-wheeled light car will be produced this year. A large part of the war damage at the important Strasbourg plant has been repaired, but it is not yet back to its pre-war condition. However, airplane engines are being produced there, and Mack diesel truck engines bought from the U. S. Army are being reconditioned. In the planning stage is production of the Moline tractor under American license.

Replacement Parts Makers Offer Price Reductions

In the replacement parts field two large producers have cracked the ice by reducing prices. Cleveland Graphite Bronze Co., largest supplier of engine bearings and bushings to the automotive industry, announced price cuts that will save purchasers an estimated \$2.5 million a year. Thompson Products, Inc., says that

it will reduce prices in May by as much as 15 per cent on some items. The company had made one price reduction on certain items early this year. It is generally believed, however, that in the parts field, price reductions will await settlement of wage demands which are expected to follow the wage increases made by the automobile manufacturers.

Silent and "Invisible" Jet Plane by Republic

A 621 mph jet airplane, reported to be silent and "invisible," is being developed by Republic Aviation Corp. Still in the experimentation stage, the new plane is expected to fly silently at over 40,000 ft without leaving a telltale trail of smoke and thus would be virtually "invisible." The P-84 Thunderjet, now being mass produced by Republic, has reportedly been flown at 621 mph.

Six Jet Bomber, XB-48, Ready For Tests

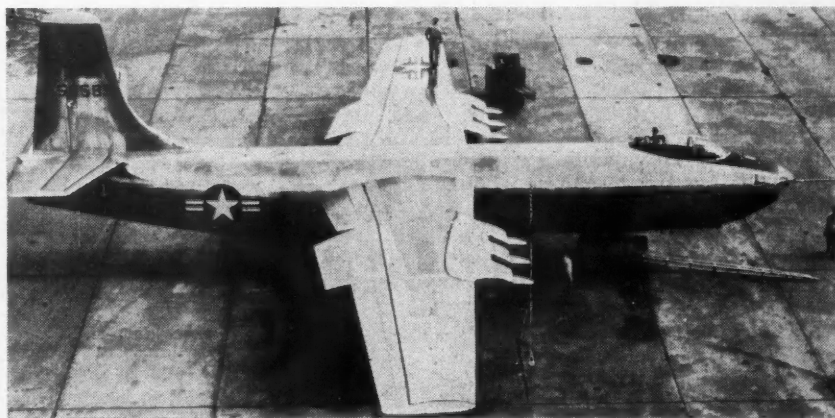
A six-engined jet bomber, the XB-48, which was built by the Glenn L. Martin Co. for the Army Air Forces, is ready for its ground and taxi tests. Six GE gas turbine engines drive the high speed bomber which is 85 ft, 9 in. long; 27 ft, 6 in. high, and which spans 108 ft, 4 in. across the wing.

The XB-48's new tandem or "bicycle type" landing gear—two main wheels in tandem underneath and retracting into the fuselage—permits an unusually thin wing for high speed. Small wheels retracting into each wing tip give stable ground operation.

Navy "Cans" Planes

The U. S. Navy will begin "canning" more than 2000 surplus carrier and trainer aircraft in June under a long-term storage program designed

And Yet More Jets for Army Bombers



The Martin XB-48, the Army Air Forces newest and largest jet bomber, is shown undergoing ground and taxi tests at the Glenn L. Martin Co. plant at Baltimore. This plane pioneers the tandem or "bicycle type" landing gear. The XB-48 has a span of 108 ft, 4 in., a length of 85 ft, 9 in., and a height of 27 ft, 6 in. Army Air Forces Photo, Washington, D. C.

NEWS of the INDUSTRY

Over the Hump to the Speed of Sound



This two foot thick rounded aluminum "bump," installed in a wind tunnel by Lockheed Aircraft Corp., boosts air velocity to the speed of sound and beyond. The faster, curved flow of air created by the "bump" has enabled Lockheed to obtain controlled, measureable speeds up to 850 mph.

to preserve the planes in a near fly-away condition for a period up to five years. A contract calling for the construction of 444 large "cans" requiring more than 20,000 tons of 14 gauge corrugated steel has been let to the Youngstown Steel Door Co. This is the first contract to be let by the Navy for other than experimental work.

Two containers of different sizes will be constructed. One container is 19 ft wide, 140 ft long and weighs approximately 110,000 lbs, while the other is 24 ft wide, 130 ft long and weighs about 100,000 lbs. Both types are 17½ ft high, and will be constructed from 10 ft corrugated steel panels.

The first type, of which 268 will be built, will be used to house Hellcats, Corsairs, and Seahawks, while the second type of which 176 will be built, will be used for Avengers and Helldivers. In full-scale tests of the "can" system, carried out at the Naval Air Station, Norfolk, Va., 50 carrier-type planes were stored in 21 separate metal units ranging from single cells to rows of 10 joined end to end.

Under the canned storage program, a total of 2020 late model planes, valued at more than \$150 million, will be preserved at six bases scattered throughout the country. The largest depot will be at the Naval Air Station, Pensacola, Fla., where 700 planes will be placed in

the metal cells. Jacksonville, Fla., and San Diego, Calif., will each get 400 aircraft; Norfolk, Va., and Alameda, Calif., will get 250 each, and 20 will be stored at the Naval Air Material Center, Philadelphia, Pa.

Vapor-tight access doors are provided in each cell to permit entry for airplane inspection. Glass windows located in strategic spots allow easy reading of five instruments which record interior temperature and rela-

tive humidity in different portions of the container.

More than 4000 aircraft are now in interim storage in the Navy. Of these, 2020 will go into "cans" and the remainder will be gradually absorbed as replacements for aircraft in service.

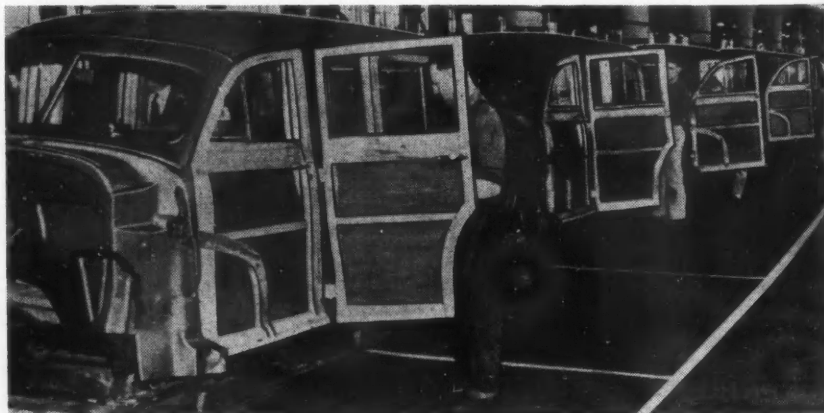
"Volkswagen" for World Markets

Several thousand German "Volkswagens" or "people's cars" are being produced each month under British supervision, according to Lloyd D. Worden, chief of the automotive and aeronautics unit of the Office of Technical Services, Department of Commerce. He added that full production of the Volkswagen might have a marked effect in the world automobile market. Originally designed to sell for less than 1000 Reichmarks or about \$400, the car is a two door coach, powered by a 23.5 hp, four cylinder air-cooled engine located in the rear; its wheelbase is 94 in. and length about 14 ft. All four wheels have independent torsion-bar suspension.

Replacement Battery Prices Increased by 10 Per Cent

Electric Storage Battery Co. has announced an increase of 10 per cent in prices of replacement batteries. However, the increase will not affect original equipment used by automobile manufacturers. The company said that higher prices of rubber, lead, and other materials made the price increase necessary.

Bodies by Fisher for Chevrolet Station Wagons

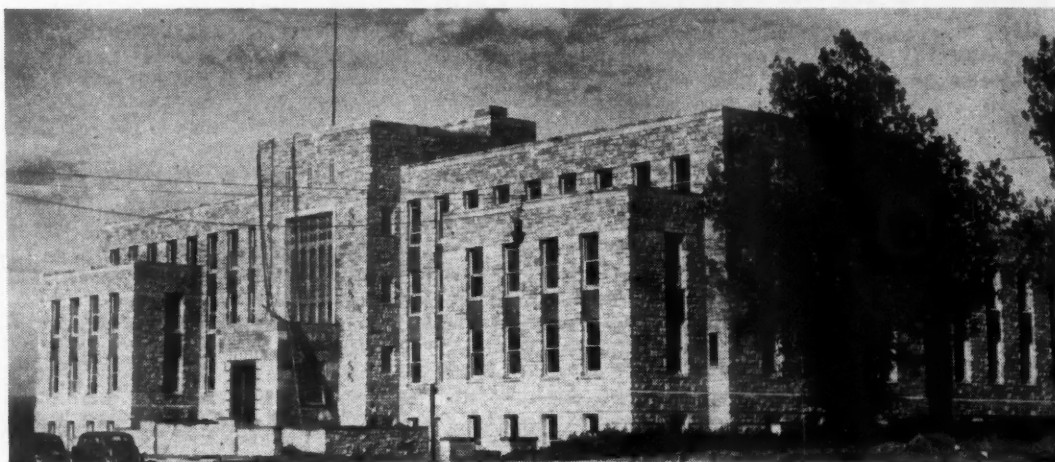


For the first time, Fisher Body is making station wagon bodies. The bodies, exclusively for Chevrolet, are in two body styles: the eight passenger with three seats, and the five passenger with two seats and a large luggage section. Allocating 150,000 sq ft of floor space at the plant in Cleveland, Fisher expects a daily rate of about 100 bodies by mid-summer.

NEWS of the INDUSTRY

This \$500,000 oil shale research and development laboratory on the University of Wyoming campus, near America's principal oil shale reserves, is being used by scientists studying methods of processing and using this important auxiliary domestic source of oil. Most of the country's oil shale reserves, comprising hundreds of square miles, are in Utah, Colorado and Wyoming. Authenticated News photo.

\$500,000 Oil Shale Research Laboratory



New Paint Drying Ovens Save Time and Space

Significant developments have been under way in equipment to conserve floor space used in paint drying ovens and also to cut the time cycle. Before the War, when steam ovens generally were used, as high as 60 minutes were required to dry a body. Today the Chrysler body plant is using a new type radiant heat gas oven which thoroughly dries a synthetic enamel finish on the body in 16 minutes. It is estimated that the company saved about $\frac{3}{4}$ of a floor in floor space. The radiant heating system also is being used for drying sheet metal parts. Ford is another company which is reported contemplating going from present steam ovens to gas-fired drying equipment in its paint department. The radiant heating gas system utilizes infra-red heat to penetrate quickly into the metal itself which will show a temperature several degrees higher than that of the oven air.

Car and Plane Income Down in '46—Others Up

For most manufacturing companies, net income after taxes in 1946 looked rather good as compared with 1945; for automobile and truck, automobile equipment, and aircraft and parts companies it looked not so good, a recent compilation by the National City Bank of New York shows. For 1511 leading manufacturing companies, net income after taxes in 1946 was \$4,091 million as compared with \$2,998 million in 1945, an increase of 37 per cent. Net income after taxes for 22 leading automobile and truck companies declined to \$129

million in 1946 as compared with \$247 million in 1945, a decline of 48 per cent; 57 automobile equipment companies dropped to \$38 million from \$52 million, a drop of 27 per cent in 1946. The 26 leading aircraft and parts companies were hardest hit with a dive to \$4 million in 1946 from \$83 million in 1945, a zoom downward of 95 per cent.

Martin Has Backlog of 301 Twin Engined Planes

Orders for about 176 model 202 and 125 model 303 twin engined transports give Glenn L. Martin Co.

a backlog of about \$87 million for commercial aircraft. Production of 25 a month of the 202's is expected by the end of this year, and in the next two or three years, Martin expects to build a minimum of 750 model 202 and 303 transports.

Wiggins Is Interim NSPA Adm. Head

Jack Wiggins will be the Acting Administrative Head of the National Standard Parts Association until the appointment of an Executive Vice-President to replace C. D. McKim who resigned recently.

Mammoth Truck by Euclid—Pay Load, 40 Tons



Built by The Euclid Road Machinery Co., this 80-ton truck has a capacity pay load of 40 tons. Powered by a 12-cylinder supercharged 550 hp Cummins diesel engine, this huge experimental truck has been shipped to the Mesabi Iron Range, Minn. Goodyear Tire & Rubber Co. made the giant tires, size 18.00-24 for the front tires and 16.00-32 for the eight on the two drive axles.

NEWS of the INDUSTRY

Ford Technique for Uniform Parts Painting

Ford Motor Co. has been engaged in research on factors effecting color variation in paint on replacement parts in connection with Newcomb-Detroit Co. Ford has found that painted fenders sent to sub-assembly plants often become damaged in shipment. Principal difficulty previously has been that branch plants had difficulty in matching original body colors because of variations in painting methods. After considerable research, Ford has established the proper temperature, type of heat, length of baking, and other factors to insure uniform and matching colors. Consequently the company now can furnish each branch with unpainted sheet metal parts and instructions for painting which will result in a part that will blend perfectly with the original body color. It has been found, for example, that a variation of as much as 20 deg in oven heat will result in an off color. However, with a definite temperature and time cycle established for all plants, results should be uniform regardless of where the part is painted.

British Start \$80 Million Supersonic Flight Center

The British Government has started construction of an \$80 million National Aeronautical Establishment at Bedford, Eng. It is expected that this supersonic flight re-

search center will ultimately be used by more than 1000 leading British aviation scientists, aided by 4000 technicians. To be primarily employed for improved jet engine design and fuel type research, the center will conduct Buck Rogers rocket experiments, particularly with regard to the feasibility of trans-Atlantic, radar-controlled rocket mail.

The largest expenditures will be for four wind tunnels, capable of wind speeds of 1500 mph. Two wind tunnels will have a 8 ft by 8 ft working section with 45,000 hp total driving power required, and there will be one, and possibly two, with a 13 ft by 13 ft section with 120,000 hp required. A wind tunnel to test wind tunnels is among the planned installations.

Production of Cars & Trucks* (U. S. and Canada)

Week ending	1947	Corresponding Week in 1941
Jan. 4.....	53,437	76,690
11.....	64,828	115,935
18.....	75,166	124,025
25.....	93,278	121,948
Feb. 1.....	94,114	124,490
8.....	89,958	127,675
15.....	97,276	127,510
22.....	103,400	127,740
Mar. 1.....	105,175	126,550
8.....	104,048	125,915
15.....	105,496	131,410
22.....	108,472	123,805
29.....	100,355	124,165
Apr. 5.....	97,385	116,255
12.....	97,893	99,260
19.....	103,148	99,945
Total	1,493,429	1,893,228

* Compiled by Ward's Automotive Reports

More Natural Rubber In Tires

An increase from three to eight lb in the amount of natural rubber to be used in medium sized passenger car tires (6.50 cross section) is now permitted by the Civilian Production Administration. Appendix II of Order R-1 also permits a choice of new rubber materials in all types of rubber tracks, track blocks, solid tires and, with the exception of tubes of 15 in. and 16 in. diam, in the production of all tubes.

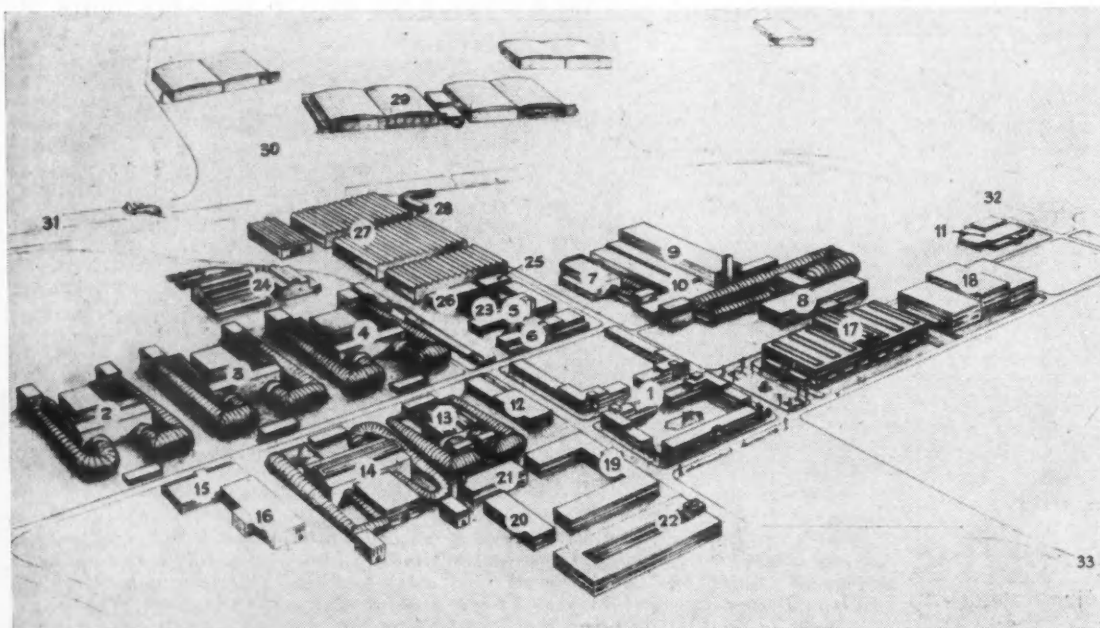
No Navions for 30 Days

Production of the Navion, North American Aviation's four place light plane, was stopped for 30 days—until about the middle of May—in order that a survey of future business might be made to determine new production rates. It is expected that the production rate of about 10 planes a day prior to the suspension will be held again.

Tucker Promises To Show in June

With production expected in July, about 25 Tucker Torpedoes, hand-built, will be shown in June, according to announcement. The first mock-up body has just been completed at Tucker's Cicero plant. Initially, one model will be produced. It is said that the price will be \$1885 in Chicago, the weight, 2700 lb.

British \$80 Million Flight Center



A diagrammatic drawing of the National Aircraft Establishment on which construction has now begun at Bedford, Eng. All aeronautical research in Britain will be centralized here, except for that carried out by private firms. The key to the diagram is on page 70. British Information Services photo.

NEWS of the INDUSTRY

Test Jet Engine Alloys in "Bomb Proof" Dugout



Scientists at the Westinghouse Research Laboratories will make use of this specially designed "bomb-proof" dugout to determine the strength properties under high temp and high rpm of alloys used in gas-turbine rotors. Disks will be heated above 1400 F by electric coils, and spun at 35,000 rpm until they fly apart under the combined attack of centrifugal force and heat.

Labor

Strike of Ford Foremen Still a Possibility

Ford Motor Co. is facing possible trouble with its foremen. The company terminated its Detroit area contract with the Foremen's Association of America on May 9. The foremen have retaliated by issuing a 30 day strike notice. Ford says that the contract signed in 1944 has not worked out satisfactorily under test. A foremen's strike of any duration could seriously handicap production in the Ford plants affected.

GM and Steel Wage Raises May Set '47 Wage Pattern

With General Motors settling its wage problem with the United Electrical Workers and the United Auto Workers of the CIO for a wage increase of approximately 15 cents an hour and with similar agreements in the steel industry, the 1947 wage pattern appears to be set.

Specifically the settlement with the UAW-CIO, which was made on April 24, calls for an increase of 11½

cents an hour plus an hourly increase of 3½ cents that is equivalent to pay for six paid holidays per year for seniority employees, who are defined as those with more than six months' experience. Wages in lieu of vacation to those with one year's seniority on July 1 of this year are to be paid on the basis of 40 hours pay, to those with three years seniority—60 hours, and to those with five or more years—80 hours. GM stipulated that the agreement must be ratified by the union by May 5, 1947. All other social security issues were left open for further discussion which indicates that they are dead for the time being. The agreement remains in effect for at least one year, after which time the wage issue may be reopened.

The 15 cent level is just a little bit higher than industry observers expected to see and it is now generally believed that price reductions are farther away than they previously had been. The only solution to lower prices is through greatly expanded volume which at present is being held up by lack of adequate materials to support output at capacity levels. According to published estimates, automotive manufacturers do not expect their production to increase particu-

larly over the next three months. With the new higher wage level, it is difficult to see how any companies will reduce automobile prices until real volume can be obtained.

Two days after GM completed its settlement Chrysler Corp. signed an agreement with the UAW calling for a similar wage increase as the GM contract—15 cents an hour including six paid holidays. The agreement also provides a nine per cent increase for salaried workers covered by UAW contract, the minimum increase to be \$26 per month. It also stipulates that the new contract must be ratified by May 6.

Wage negotiations are pending with Ford, Kaiser-Frazer, Hudson and Packard. Nash employees recently settled for 10 cents an hour under an open-end contract and it is expected that they will receive the increase up to 15 cents an hour.

Electric Auto-Lite Cuts Spark Plug Drying Time

Electric Auto-Lite Co. has been doing some extensive research in an attempt to cut the drying time required for the ceramic core used in its spark plugs. Previously it took seven days to dry the core completely. Experiments with drying equipment showed that the time could be cut considerably but some difficulty was encountered with the binder, which is used in the clay composition, coming to the surface and gumming up grinding wheels. However, some changes were made in the binder material and at last reports the drying cycle had been reduced to 12 hr.

Lead Supply Improvement Expected by End of 1947

Spokesmen for the lead industry indicate that they can see a meeting of supply and demand for the first time in several years. Consensus is that by late this year the lead shortage will be merely an unhappy memory and that at that time it is even possible that prices may drop a bit.

Ford Control Feminine

Under the terms of Henry Ford's will, eventual control of the Ford Motor Co. will pass into the hands of his four grandchildren, Henry Ford II, Benson Ford, Mrs. Walter Buhl Ford II, and Wm. Clay Ford. The will provided that all of Mr. Ford's class "B" (voting) stock in the company be divided into five equal parts among his son, Edsel, and his four grandchildren. At the time of his death, Mr. Ford held

(Turn to page 68, please)

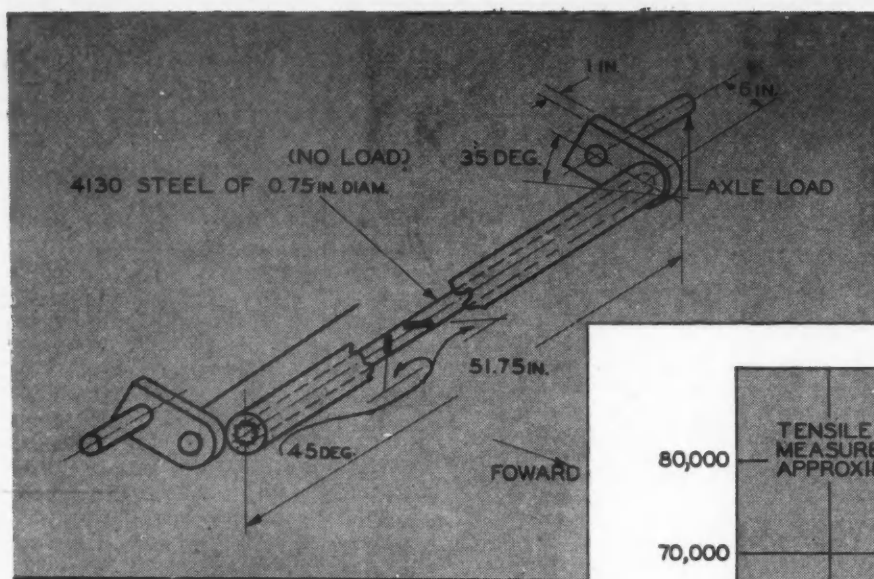


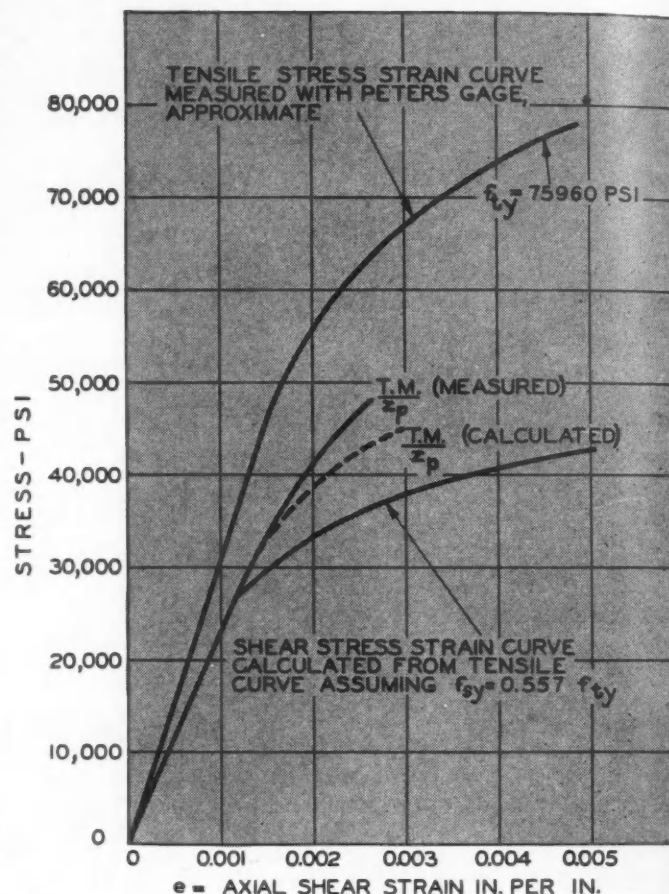
Fig. 1—(Above) Torsion suspension system of the Kit Kamper

Fig. 2—(Right) Axial strain vs stress for torsion bar

THE torsion rod suspension system of a light, two-wheel trailer known as the Kit Kamper, Model C, was analyzed and road tested to determine shear stresses in the torque rod under various conditions in order to predict the fatigue life of the system. The torsion rods of the Kit suspension system, shown in Fig. 1, are 4130 annealed steel and housed in steel tubing and joined to arms on the wheel axles. The initial angular offset (35 deg) of the axle arm, is intended to produce a springing system that will ride "soft" at low loads and "hard" at high loads, the latter requirement to prevent overstressing of the torque rod. As the wheel load increases, the arm rotates, decreasing the effective moment arm by the cosine of the angle between the arm center line and the horizontal. The effectiveness of this arrangement was evidenced by drop tests which showed that a very great increase in drop height was necessary to produce even a slight increase in torque rod shear stress after 35,000 psi had been reached.

Road and drop tests were conducted in which accelerations at the cab center of gravity and strains at the outside surface of the torque rod were measured. The road tests were made at two levels of tire pressure, 35 lb and 12 lb. The trailer was driven over a rough dirt road at various speeds and also over a railroad crossing at 50 mph. The gross weight of the trailer was approximately 1000 lb for all road tests. For drop tests, the trailer was connected to a car bumper at the ball hitch and dropped from heights of 3, 6 and 9 in., measured from the bottom of the tire to the ground.

To obtain the strains on the outside surface of the torque rod of the suspension system, two electric strain



gages of the SR-4, A-6 type were cemented to the rod as shown in Fig. 1. As the gages were set at 45 deg to the center line of the torsion rod, pure torsion caused one gage to read in compression and the other in tension. During severe road shocks the torque rod itself would deflect within the housing, superimposing bending stresses upon the shear stresses (resulting from ground loads at the wheel). The location of the gages was such that any bending strains encountered in the vertical plane would be canceled out in the individual gages, while strains resulting from bending in the horizontal plane would cause one gage to read low and the other to read correspondingly high. If the gages were averaged together the resultant average strain would equal the shear due to torsion alone.

Accelerations on the cab center of gravity were obtained from an AR-12V-250, 12 G Statham electric accelerometer. The strains and accelerations were re-

Torsion Rod Suspension

Features Welded Construction

Stress Analysis and Road Tests of Light Vehicle Springing System Are Described in This Article

recorded on a Heiland portable aircraft oscillograph Model A 401 R with A type galvanometers.

Since the strain gages recorded only strain, it was necessary to determine the stress-strain curve of the torque rod material in order to determine accurately the shear stress from the recorded axial strains. A standard ASTM round tensile coupon and a full section of the torque rod were tested to destruction in tension with an autographic record

By Given Brewer

Consulting Engineer

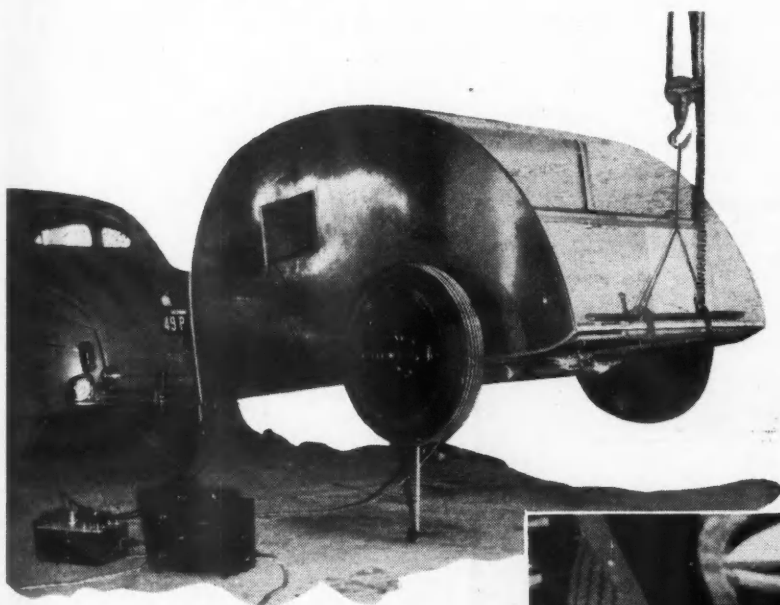
of load and extension recorded during the test. The physical properties of the torque rod are given in Table I and plotted in Fig. 2.

If a tension stress-strain diagram is available for a given metal, it is possible to draw a shear stress-strain curve for the material below the proportional limit, using the following relationships:

$$e_s = \frac{f_s}{E} (1 + \mu)$$

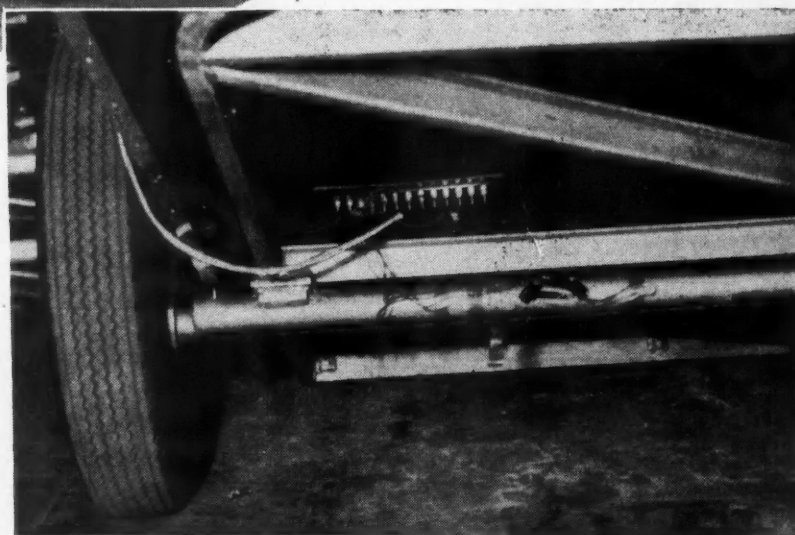
Table I *Physical Properties of Torque Rod Material*

	ASTM Round	Full Section
Diam. in.	0.502	0.746
Area, sq in.	0.198	0.437
Ult. load, lb.	17480	37800
Ult. stress, psi.	88280	86500
Yield load lb.	15040	32600
Yield stress, psi (0.002 in. per in.)	75960	74600
Elongation per cent 2 in., 3 in.	19.5%	2.47%
Red. Area, per cent.	64.5	64.3



The Kit Kamper shown above is suspended for drop test. The recording oscillograph and the mixing box, used for recording dynamic strains on the torque rod, are shown at the left

At right is a view of the Kit Kamper suspension system showing the strain gage installation. Holes were cut in the outer housing, and the gages were cemented to the torsion bar



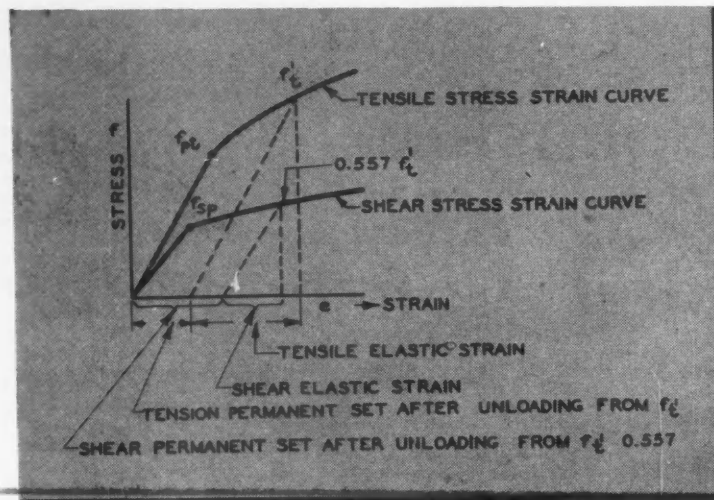
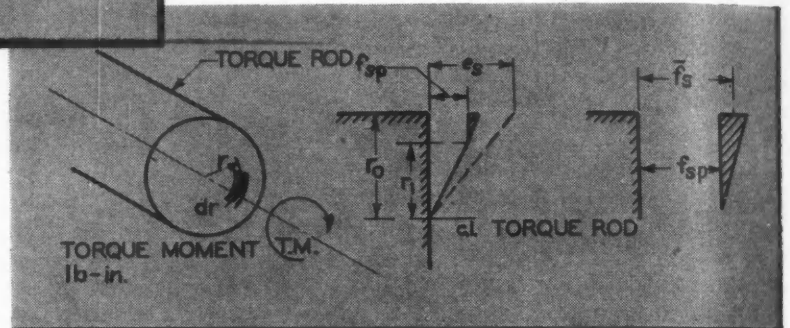


Fig. 3—(Left) Strain vs stress diagram

Fig. 4—(Below) Analysis of torsion bar torque moment



$$e_t = \frac{f_t}{E}$$

where: e_s = axial shear strain, in. per in.

e_t = axial tension strain, in. per in.

μ = Poisson's ratio of 0.30 for steel.

f_s = shear stress, psi

f_t = tensile stress, psi.

E = Young's modulus for steel, 30×10^6 psi.

Under simple tension the tensile proportional limit of a metal is 1.792 times the shear yield, hence the proportional limit in shear is easily found as 0.557 times the tensile value. In the plastic regime, the shear stress-strain curve may be approximated by breaking down the tensile curve into two components, a permanent set strain and an elastic strain. The permanent set in shear will be 1.5 times the set in tension. The elastic shear strain will continue to be 1.3 times

the elastic tensile strain for the same stress. This construction is illustrated in Fig. 3 and is plotted for the torque rod material in Fig. 2.

The torque moment (T.M.) of the torsion rod (see Fig. 4) was calculated as follows:

$$T.M. = \frac{r_1^3}{2} \cdot \pi \cdot f_{sp} + \int_{r_i}^{r_o} \frac{r_o}{f_s} \cdot 2 \pi r^2 dr$$

$$T.M. = \frac{\pi \cdot r_1^3}{2} \cdot f_{sp} + \frac{2}{3} \pi \cdot f_s (r_o^3 - r_i^3)$$

$$f_{sa} = \text{shear stress at } e_s \text{ if material had } \alpha \text{ yield} = \frac{E \cdot e_s}{1 + \mu}$$

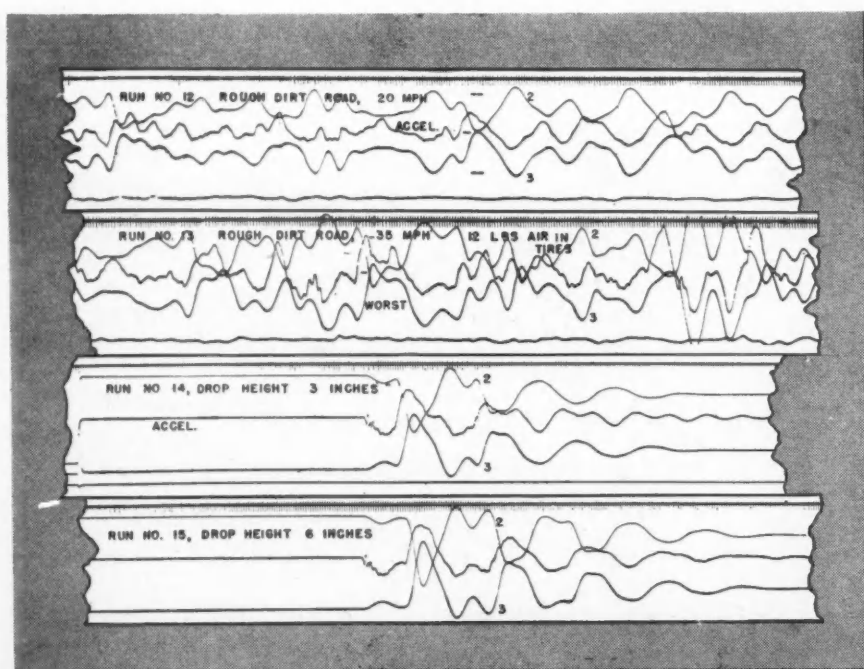
f_{sp} = proportional limit in shear.

f_s = average shear stress between r_i and r_o .

$$K = \frac{f_s}{f_{sp}}$$

$$\frac{r_i f}{r_o} = \frac{sp}{f_{sa}}$$

Final formula is as follows:



Shown here are the oscillograph traces of the acceleration of the cab center of gravity and the strains on the torque rod for test runs Nos. 12-15. The timing marks at the top of each trace are 0.01 sec apart.

New Torsion Rod Suspension

(Continued)

$$T.M. = \pi f_{sp} \cdot \tau_a^3 \left\{ \left(\frac{f_{sp}}{f_{sa}} \right)^3 \cdot \frac{1}{2} + \frac{2}{3} K \left[1 - \left(\frac{f_{sp}}{f_{sa}} \right)^3 \right] \right\}$$

From the formula for the torque moment ($T.M.$) given above, the shear modulus of rupture (F_{bs}) was found as follows:

$$F_{bs} = \frac{T.M.}{Z_p} = \frac{T.M.}{.083} \text{ for 0.75 in. diam rod.}$$

In the case where applied torsion caused the shear yield of a round bar to be exceeded, the relationship between stress and strain became difficult to predict from a tension diagram. However, under some of the road and drop test conditions, the shear yield of the torque rod was exceeded and it was necessary to construct an approximate shear modulus of rupture vs axial shear-strain diagram in order to determine the effective outside fiber stresses for the strains observed.

The curve of shear modulus of rupture vs axial shear strain is shown as dotted in Fig. 2. Using four A-6 strain gages and the strain indicator, a section of the torque rod was tested in pure torsion and the experimental points so determined were plotted on Fig. 2 to compare with the curve theoretically derived.

Since the torsion rods are welded to their supports, the fatigue life of the system cannot be predicted from published information. The effect of welding is to reduce the endurance limit of the basic metal from 20 per cent to 80 per cent. Accordingly a fatigue test jig was made wherein the trailer could be lifted from the ground and allowed to drop, producing stresses of the design magnitude. To date the suspension system has withstood 165,000 applications of about 28,000 psi shear stress without failure.

The effect of tire pressure is quite important in influencing the magnitude of the stresses encountered in service. Using 12 lb of air in the tires instead of 35,

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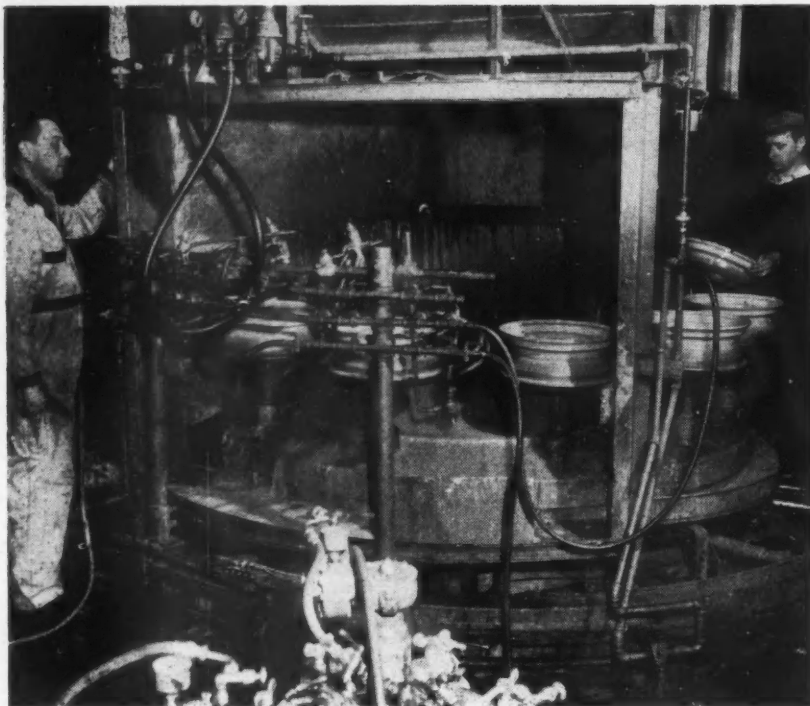
Table II—Summary of Road and Drop Test Data

Torque Rod 4130; $F_{tu} = 88,280$ Psi; $F_{ty0.002} = 75,960$ Psi; O.D. = 0.746 In.

Run	Description	Gross Weight Lb	ϵ_2	ϵ_3	Acceleration Deficiency	f_s max (Gages) psi	G'S Torque Rod £	G'S Accelerometer	Equivalent Drop Height
1	Calibration 12 Volts	~	0.425 in. 1000 mic. in. in.	0.450 in. 1000 micro.	0.225 $\frac{\text{in.}}{G}$	~	~	~	~
6	R. R. Track 50 mph 35 lb Air Tires	1000	-0.67 in.* -1575 mic.*	+0.68 in.* +1510 mic.*	~	30510	2.10	~	1.95 in.
7	Dirt Road 25 mph 35 lb Air	1000	-0.70 in. -1645 mic.	+0.68 +1510 mic.	+0.53 in.	31000	2.20	3.35	2.0 in.
8	Dirt Road 35 mph 35 lb Air	1000	-1.17 in. -2750 mic.	+1.11 in. +2460 mic.	>1.03 in.	46000	4.60	~5.57	9.0 in.
9	R. R. Track 50 mph 12 lb Air Tire	839	-0.44 in. -1035 mic.	+0.445 in. +990 mic.	+0.32 in.	19010	1.4G	2.42	0.80 in.
11	Dirt Road 15 mph 12 lb Air	1000	-0.51 in. -1200 mic.	+0.53 in. +1175 mic.	+0.35 in.	22760	1.45	2.55	1.05 in.
12	Dirt Road 20 mph 12 lb Air	970	-0.55 in. -1295 mic.	+0.58 in. +1290 mic.	+0.30 in.	28200	2.00	2.33	1.65 in.
13	Dirt Road 35 mph 12 lb Air	970	-0.76 in. -1790 mic.	+0.73 in. +1620 mic.	+0.55 in.	33000	2.60	3.44	2.40 in.
14	Drop 3 in. 12 lb Air	629	-0.825 in. -1940 mic.	+0.800 in. +1776 mic.	+0.44 in.	~**35000	4.52	2.95	3.00 in.
15	Drop 6 in. 12 lb Air	629	-1.02 in. -2400 mic.	+0.975 in. +2165 mic.	+0.475 in.	~39000	~6.0	3.11	6.00 in.
16	Drop 9 in. 12 lb Air	629	-1.15 in. -2075 mic.	+1.10 in. +2440 mic.	+0.775 in.	~41200	~6.5	3.44	9.00 in.

* Zero reference for all strains was taken with trailer off ground; A. L. = 51 lb.

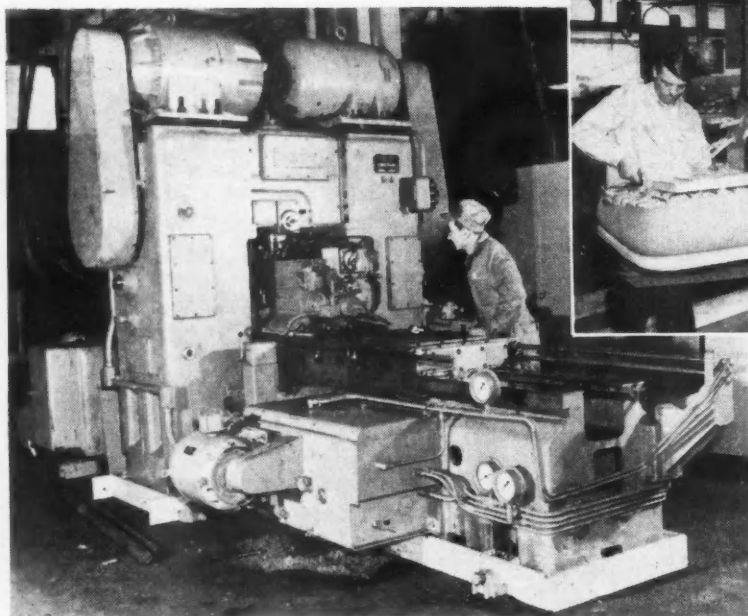
** ~ Approximate due to yielding in run #8.



← This automatic wheel-painting machine, built by the Schweitzer Equipment Co., is capable of painting 1000 wheels per hr. The rotary work table can handle 12 wheels at one time, and is equipped with machinery which spins the wheels continuously as they are moved past the paint sprayers. The spray mechanism is synchronized with the speed of the work table, and presents four guns arranged to reach every section of the wheel. As the wheels leave the spray mechanism, they are removed from the fixture and placed on a monorail conveyor which carries them through the drying oven and then to the wheel and tire assembly

The machine shown here is a special Sundstrand Rigidmil designed for milling the Kaiser-Frazer engine cylinder block. Fitted with six milling cutters, the machine semi-finishes the top surface, and finish-mills the bottom face, manifold pad, valve cover surface and fuel pump pad in one pass. The block is held in an electrically operated fixture. Milling cutters are arranged as follows: two, 6-in. inserted blade cutters for roughing the bottom surface and a single 13-in. cutter for finishing. The top surface is milled to size with one 8-in. face mill. The manifold and valve cover faces are milled with a single 7½ in. cutter while the fuel pump pad is milled by a 5¼ in. cutter.

Kaiser-Frazer



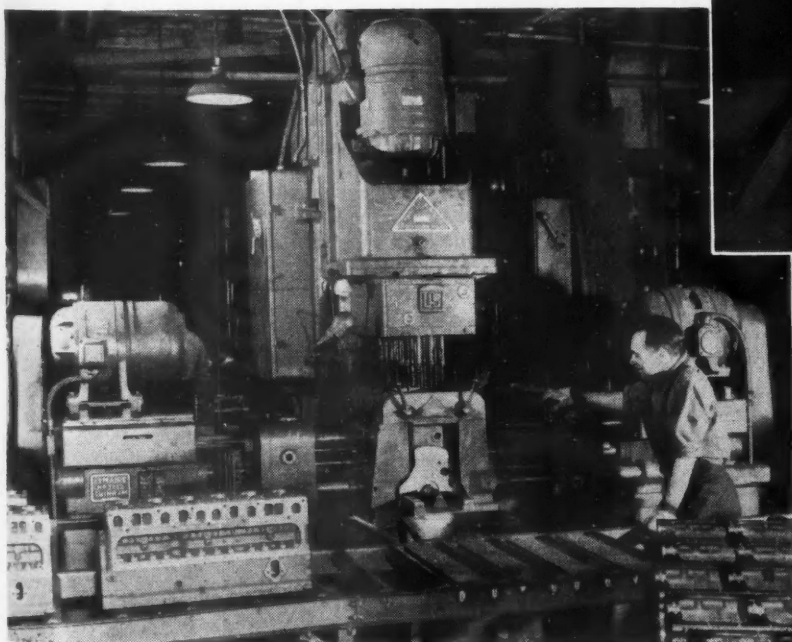
↑ A merry-go-around type conveyor is also used to build seat cushions. This long monorail conveyor represents part of a total of 54,857 ft of monorail in use at the Kaiser-Frazer Willow Run plant



← Balcony space is utilized to advantage at the Kaiser-Frazer Willow Run plant. The front-end sub-assembly, shown in this photo, is located on a balcony directly above the final assembly line. The front-end units travel through the sub-assembly on a merry-go-around conveyor, and then are lowered to the final assembly line by the overhead electric hoist at the left

Production Innovations

Special three-way multiple drilling machine built by Le Maire for Kaiser-Frazer cylinder blocks. Containing a total of 63 spindles, it drills the top and sides of the block and counterbores for welch plugs. The vertical head has 34 spindles, one horizontal head has 19 spindles while the other has ten. Work is positioned in the fixture by a half-round locator, is located by two manually operated pins, and locked in place by toggle clamps. Welch plug counterbore is held to a tolerance of 0.003 in.



↑ A unique device at the end of the final assembly line provides an automatic means for raising an exhaust-gas deflecting plate for removing engine fumes. The front wheels of the car interrupt a photoelectric light circuit, actuating a solenoid which controls the mechanism for raising the deflecting plate shown in the photo. Thus, engine fumes are forced downward into a gas disposal duct

Latest Developments

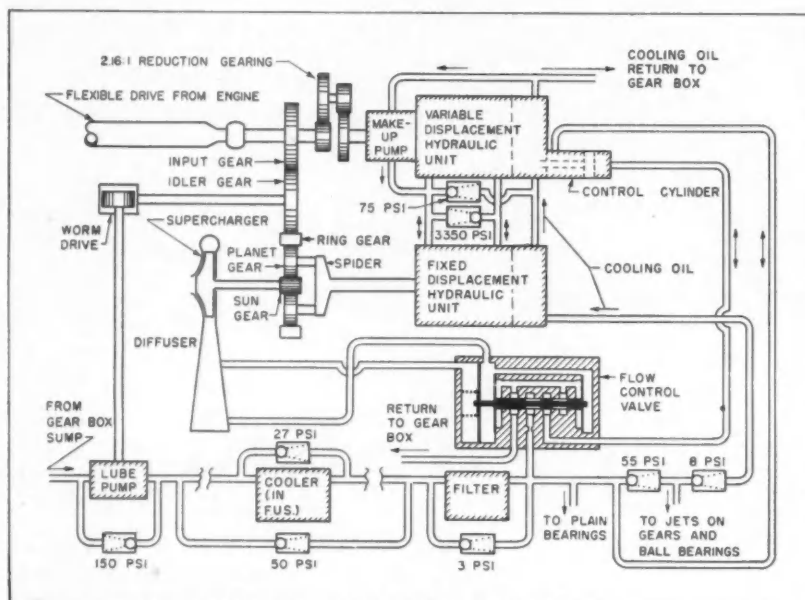


Fig. 1—Schematic diagram of cabin supercharger drive for Douglas DC-6

Some Applications of Hydraulics to High Speed, Rotary Drives for Aircraft Accessories

**By W. W. Thayer,
Air Conditioning Group,
Engineering Department
Douglas Aircraft Co., Inc.**

THE hydraulic-mechanical cabin supercharger drive developed for the DC-6 is shown in Fig. 1. Power is delivered from the engine through a flexible drive shaft to an input gear, through an idler (which drives the lubrication pump through a worm drive), to the ring gear. A spider is attached to the hydraulic unit; and the sun gear to the supercharger. Thus, the unit attached to the spider can run in one direction as a pump to slow down the supercharger, or in the opposite direction as a motor to speed it up. When acting as a pump, it delivers its power to an "overcenter" variable displacement unit, which, under these conditions, acts as a motor feeding the power back into the drive shaft. When the fixed displacement unit acts as a motor, the variable displacement unit, overcenter in the oppo-

site direction, pumps power into it. Due to the overcenter feature of the variable displacement hydraulic unit, the same line joining the two hydraulic units is always the high pressure line; and the opposite line is always the low pressure line. It is thus possible to provide a relief valve between these two lines, and limit the maximum torque that can be developed during sudden acceleration of the engine, which might be too rapid for the flow control system to follow.

The flow control system is exceedingly simple. Filtered hydraulic oil from the gear box pressure lubrication system is supplied to a lapped slide valve, which is actuated by air pressure across a diaphragm, opposing a spring load. The two pressures acting on opposite sides of the control diaphragm are taken from taps on the conical supercharger diffuser at two different cross sectional areas. Depending on whether the pressure differential across these two taps is above or below the desired value, the slide valve moves to port oil into or out of the control cylinder. This moves the cylinder-block of the variable displacement unit in the direction which will tend to restore the desired flow conditions.

In order to improve the life and performance of the hydraulic units, the low pressure hydraulic line between them is pressurized to 75 psi. The same oil circulates continuously between the two hydraulic units in the so-called "bridle circuit," so that a small capacity makeup pump, which replaces the leakage from the system, and a 75 psi relief valve are all that is required to maintain the low pressure line at the desired pressure.

The lubrication and cooling system for the gear box and hydraulic brake circuit is also shown in Fig. 1. A lubricating pump is driven from the idler gear through a worm drive. It pumps oil through a cooler, located in the fuselage, and through a filter. This high pressure oil is supplied to the bearings and supercharger flow control circuit. Oil at a reduced pressure is supplied to various cooling and lubricating jets built into the gear box; and the remaining oil is flushed through the cases of the hydraulic units to carry away excess heat.

Installation Engineering of Aircraft Turbo-Jet Engines

**By R. E. Small,
Aircraft Gas Turbine Div.,
General Electric Co.**

APPRECIABLE progress has been made in the improvement of engine design from the installation standpoint since the start of the turbo-jet projects a few years ago. The art is now reaching the stage where refinements, such as the variable jet nozzle and thrust augmentation, are being actively investigated in addition to further research and development on the basic components.

The type I-40 turbo-jet incorporates a three-point support: two main trunnions in the horizontal plane; and a front support in the vertical plane, either at the top or at the bottom of the accessory gear case. The principal loads are carried by the two main trunnions. It has been recommended that spherical bushings be provided on each of the main trunnion journals; one bushing to be fixed so it could not slide along the trunnion journal; the other

s in Aeronautics

Presented here are brief and meaty abstracts of important papers from the SAE National Aeronautic Meeting, held in New York City April 9-11

bushing to be free to slide as contraction and expansion or structural deflection occurred. Fig. 2 shows such a spherical-bushing mount configuration. In the installations using the spherical-bushing support, very satisfactory performance has been obtained with this metal-to-metal mount. However, investigation of the possibility of fatigue failures occurring in the mounting parts indicates the desirability of providing vibration absorption in the mount, and for this reason many of the newer installations incorporate anti-vibration material in the mount design.

Fig. 3 shows another recent development, an external bulkhead between the

operation; provide more-rapid change in thrust during acceleration; permit cooler starts; compensate for thrust variation among engines, so that all turbo-jets in a multi-engine airplane will deliver equal thrust; and permit maintaining maximum allowable ex-

of the installation; however, the benefits to be gained through use of such a nozzle appear to outweigh appreciably the disadvantage of increased installation complexity.

The Effect of CAB Requirements on Airplane Design

By John E. Steiner,
Senior Aerodynamicist
Boeing Aircraft Co.

A METHOD of analyzing basic airplane characteristics has been developed as an aid in designing transport aircraft within the performance requirements of the Civil Air Regulations. This method is believed to be interesting because it allows for the consideration of a very wide range of variables and does not involve any special performance method.

The examination involves airplane wing loading W/S, takeoff power loading W/P, and the ratio of takeoff power to wing area P/S. A plot

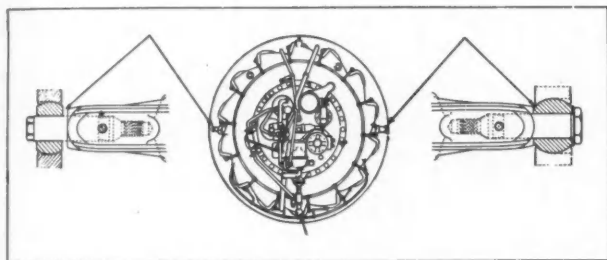


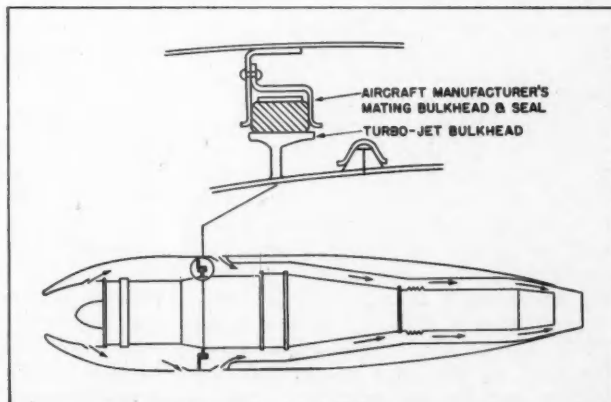
Fig. 2 — Typical spherical bushing support for I-40 turbo-jet

compressor and turbine section. The purpose of this bulkhead is to prevent fuel from entering the region around the combustion, turbine and exhaust sections in the event that fuel leakage occurs in the compressor and accessory sections of the engine. The addition of the bulkhead across the nacelle at this point requires that the cooling air inlet louvers for the aft section of the nacelle be located on the rear side of the bulkhead. A louver is also generally provided ahead of the bulkhead at the bottom of the nacelle, through which is discharged the ventilating air from the compressor section.

Most of the turbo-jet installations which have been flown to date have used fixed, or constant area, jet nozzles. The need for a jet nozzle with variable area has become more apparent as experience has been obtained. From the operational and performance standpoints, the use of a variable area nozzle and properly integrated control, on the axial-flow turbo-jet should: give better fuel economy during cruising

haust-gas temperature at full rpm, regardless of changes in compressor inlet temperature or pressure ratio across the jet nozzle. Studies have also shown that a variable area nozzle will be required for most methods of thrust augmentation. The variable nozzle and its control will add to the complexity

Fig. 3 — Schematic diagram showing firewall bulkhead between compressor and turbine sections of turbo-jet engine



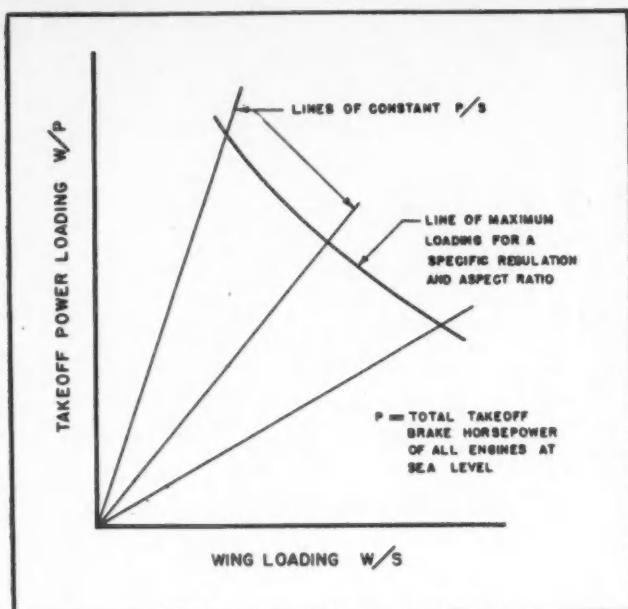


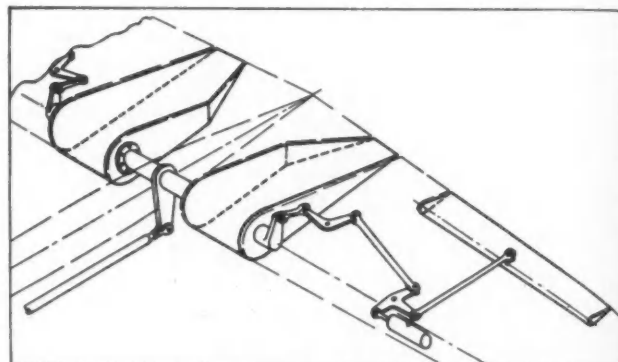
Fig. 4—Plotting form used in analyzing aircraft characteristics

of power loading vs. wing loading, as shown in Fig. 4, is used. Points on any radial line passing through the origin will have a constant ratio of wing loading to power loading and therefore, of power to wing area, P/S . Since a single-engine takeoff power rating has been chosen, any given airplane will have a constant value of P/S which will, of course, be independent of weight. Points representing a given airplane will move out along one of the radial lines of constant P/S as the airplane is loaded heavier and heavier. However, its performance will decrease, and at some point it will just meet a given climb requirement of the Civil Air Regulations. Further loading and consequent movement out along the P/S line will not be allowable. If these maximum allowable points can be determined for similar airplanes having various P/S values, and connected together, a line of maximum loading for a specific regulation will be formed. Wing area alone, of course, does not define wing planform. A single additional quantity, aspect ratio, will define it adequately for purposes of a general study. The maximum loading line will therefore apply to a specific regulation and aspect ratio. This maximum loading line will be non-dimensional and will be limited in meaning only by the assumptions used in setting up the airplanes at each value of P/S . While a given engine horsepower may be used in constructing the chart, the limiting line will be valid for any similar engine of different power provided only that adjustment is made for the ratio between takeoff and maximum continuous powers for regulations where the latter is used. If the above study is completed, a region of airplanes complying with a given Civil Aeronautics climb requirement, bordered by the axes to the left and bottom and by the maximum loading

line to the right and top, will be formed.

Since takeoff performance depends basically upon power loading and wing loading, lines of constant takeoff field length may be added to the plot. Moreover, landing field length depends largely upon wing loading, at present,

Fig. 5—Flelevator and spring tab arrangement



so that lines of constant landing field length may also be added. Should the use of reverse pitch propellers be allowed in the future, this effect, too, may be portrayed. In addition, the cruising speed of airplanes having similar aerodynamic cleanliness and aspect ratio will be dependent upon altitude, power loading and wing loading. If power and altitude are selected, lines of constant cruising speed may also be plotted. Thus it appears that if the desired takeoff and landing field lengths and the desired cruising speed are known, as is usually the case, all of the permissible combinations of wing area, engine power, weight, aspect ratio, and engine supercharging can be selected by inspection from a small number of charts. More detailed structural weight and operating cost calculations may then be made for this greatly reduced number of airplanes

and a final choice made of the most effective design. This method appears to be quite general and logical.

Naturally, the immensely complicated job of choosing the basic configuration for a new airline cannot be solved quite as easily as the above discussion might indicate. One must first know approximately the type of airplane desired, the degree of aerodynamic cleanliness expected, and the type of power plant to be used. However, the method is completely general, and a set of charts may be constructed for any combination of assumptions.

A Longitudinal Control System for High Speed Aircraft

By Harold O. Wendt,
Aerodynamics Engineer,
Curtiss-Wright Corp.

RECENT increases in the size and speed of fighter planes have increased the problem of providing air controls which can be handled satisfactorily by the pilot. Power boosts and spring tabs have been used, with and without aerodynamic balance, but both methods have certain disadvantages. The power boost is susceptible to mechanical and hydraulic failures, and requires a relatively large amount of maintenance. The spring tab can produce control forces which are light

enough, but control forces tend to lighten with increasing speed, making it possible for the pilot to impose excessive loads on the airplane's structure. The system described here, as applied to the elevator of fighter airplane, gives a much smaller variation

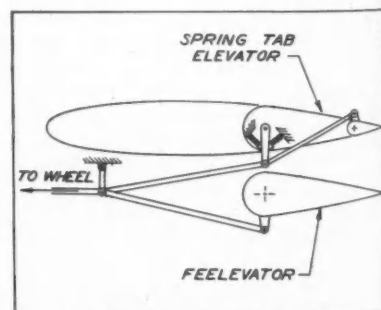


Fig. 6—Schematic diagram of a spring tab elevator and a flelevator

of pilot force per unit normal acceleration (wheel force per "g") with airspeed than does the spring tab alone.

This new system for obtaining the required control force characteristics is shown in Fig. 5. It consists of two elevators on each side of the airplane. The large outer elevators are conventional spring tab elevators, connected together and to the pilot's control column through a spring, as shown in the upper part of Fig. 6. As in any conventional spring tab elevator system the pilot's control is directly connected to the spring tab so that any deflection of the spring results in a relative motion between the elevator and the spring tab. This motion of the tab is in such a direction that the tab helps the pilot to move the elevator. The inner elevators are called "feel-elevators." These feel-elevators are directly connected to the pilot's control stick as indicated in the lower part of Fig. 6. The function of the feel-elevators is to provide a control force in addition to that from the spring tab elevators. This additional control force per "g", unlike the spring tab control force per "g", increases slightly with increasing airspeed. This tends to reduce the variation of stick force per "g" with airspeed.

Use of 75ST in Structural Applications

By George Snyder,
and Frank J. Crossland,
Boeing Aircraft Corp.

THE material known as 75ST is a new high strength aluminum alloy that can be used in certain aircraft structural applications to effect a saving in weight or an increase in strength or both over designs using other alloys. The B-29 wing was redesigned in 75ST and is an excellent example of the use of 75ST in an aircraft structure. The redesigned wing was 16 per cent stronger and 650 lb lighter than the original wing. This gain was made in basic structure only, that is, in the spars and the inter-spar surfaces. The inter-spar ribs and structure forward of the front spar of aft of the rear spar were not changed.

The upper surface of the inboard wing was constructed of heavy-gage skin stiffened with hat-section extrusions. A comparison of several test panels typical of the upper surface are shown in Fig. 7. It should be noted that the 75ST panel skin is 0.156 in. thick and is alclad, but nevertheless withstood more load than the 24S panel with 0.188 in. 24SRT (bare) skin. As a result of these and other tests, all of the upper-surface inter-spar skin on the inboard wing was changed from 24SRT (bare) to 75ST alclad and reduced one gage in thickness. A slight reduction was also made in stiffener area, the web of the 75ST stiffener being changed from 0.13 in. to 0.11 in.

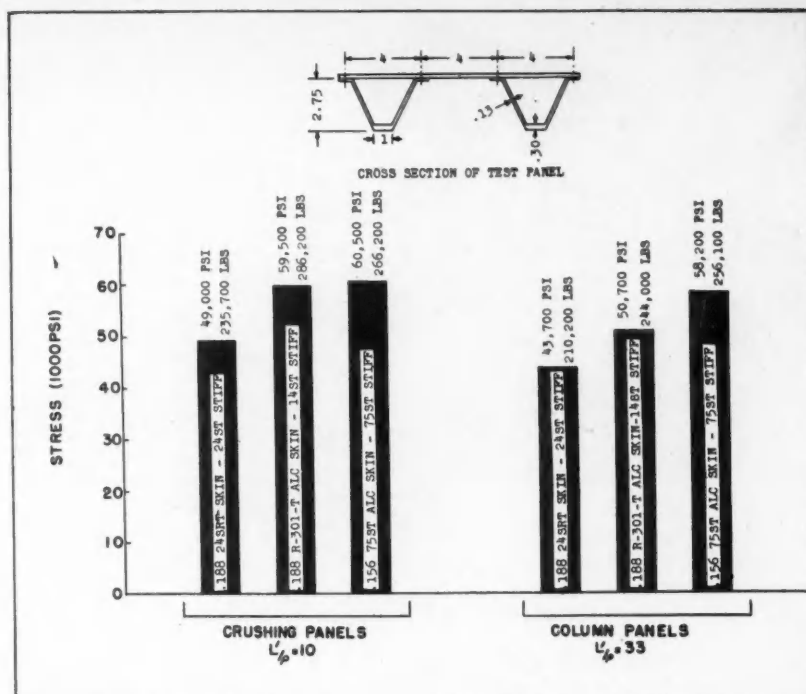


Fig. 7—Comparison of several test panels of upper surface of B-29 wing

The lower surface of the wing was constructed of relatively light-gage skin and stiffened with formed hat sections. All stiffeners and skin were changed from 24ST alclad or 24SRT to 75ST alclad, but gages were not changed. This substitution, therefore, increased the tensile strength, but did not save weight. The outer wing surfaces and all spar webs were changed to 75ST alclad. In many areas it was possible to reduce sheet gages and an appreciable weight savings was realized.

A lower skin reinforcement plate formed in 0.188 in. thick 75ST replaced three parts used on the original wing. The plate was formed to fit the wing contour and to provide a flange along the aft

perimeter of the wheel-well cutout. On the original wing a flanged plate formed of 0.156 in. 24SO and heat treated to 24ST was attached in the area adjacent to the cutout. The flat portion of this plate was reinforced with a 0.125 in. thick steel plate. Most of the area aft of the cutout was reinforced with a 0.188 in. 24SRT plate. Had it been possible to form the cutout flange in 0.188 in. 24SRT, only one piece would have been required but the SRT properties are the result of a rolling operation and, if the part were heated to permit forming, only ST properties could be obtained. For the redesigning wing, it was possible to use one piece because a mechanical operation, such as rolling, was not required to obtain the maximum properties.

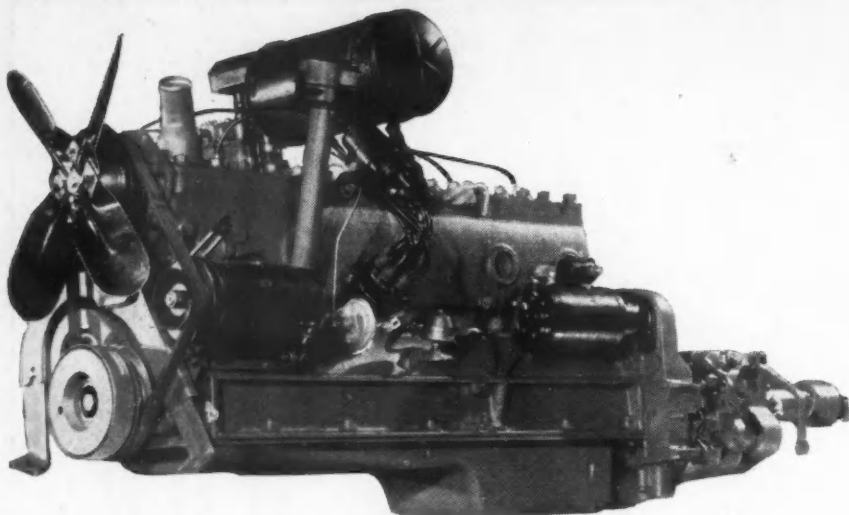
Decimal Dimensions in Aviation and New Numbering System for Anti-Friction Bearings

Decimal dimensioning, which affords major benefits of the metric system without simultaneously creating wholesale disruptive conversion headaches, is being increasingly used by the American aeronautical industry.

A survey by the Aeronautical Drafting Committee of the Society of Automotive Engineers, made among airlines operators and manufacturers of planes, powerplants, propellers, and accessories, discloses that 80 per cent now employ decimal dimensioning or contemplate its early adoption. Users explain that the practice of expressing limited measurements in decimals rather than fractions of inches contributes to speed and to accuracy both in de-

sign and in manufacturing practice.

A standardized numbering system for ball and roller bearing dimensions was presented recently to the American Standards Association by the Anti-Friction Bearing Manufacturers Association. The new code calls for a common means of identifying types, sizes, tolerances, modification of internal design and lubrication of standard ball and roller bearings to meet all the requirements of users. This new identification system utilizes a combination of figures and letters alternately and is flexible enough to take care of future changes in design, tolerances, lubricants and separator materials and is semi-descriptive rather than a dead code.



Design Features

1948

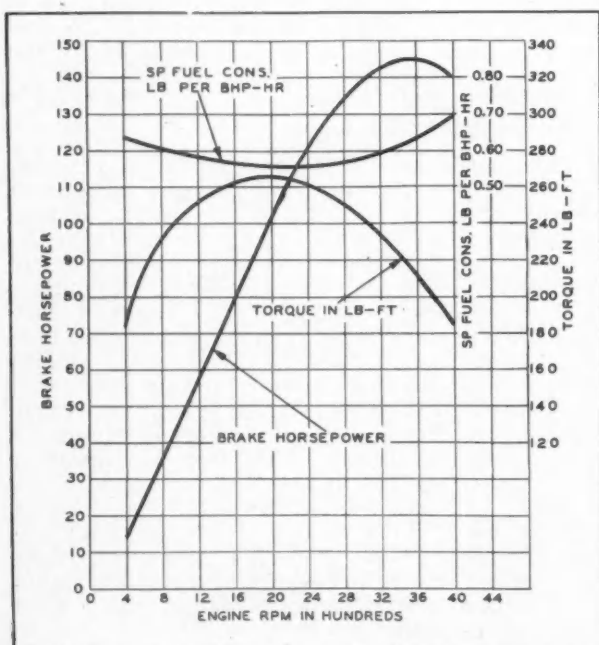
Major Specifications of Packard's Super-Eight Engine

Engine	L-head, eight cylinders in line.
Max BHP	145 at 3600 rpm
Max Torque	266 lb-ft at 2000 rpm
Bore	3.50 in.
Stroke	4.25 in.
Displacement	327 cu in.
Compression Ratio	7.00 to 1
Engine Clutch and Trans. Weight	849 lb
Cylinder Head Material	Cast iron
Piston Material	Auto-thermic aluminum alloy
Connecting Rod Material	Steel forging
Main Bearings	Five
Clutch	Single dry plate
Transmission	Selective-silent-synchronized
Frame	XX-member type with box section side rails
Steering Gear	Packard-Gemmer worm and three-tooth roller
Front Suspension	Packard Safe-T-Flex independent parallelogram
Rear Suspension	Semi-elliptic springs 54.375 in.
Wheelbase	120 in.
Overall Length	195.625 in.
Shipping Weight	4170 lb

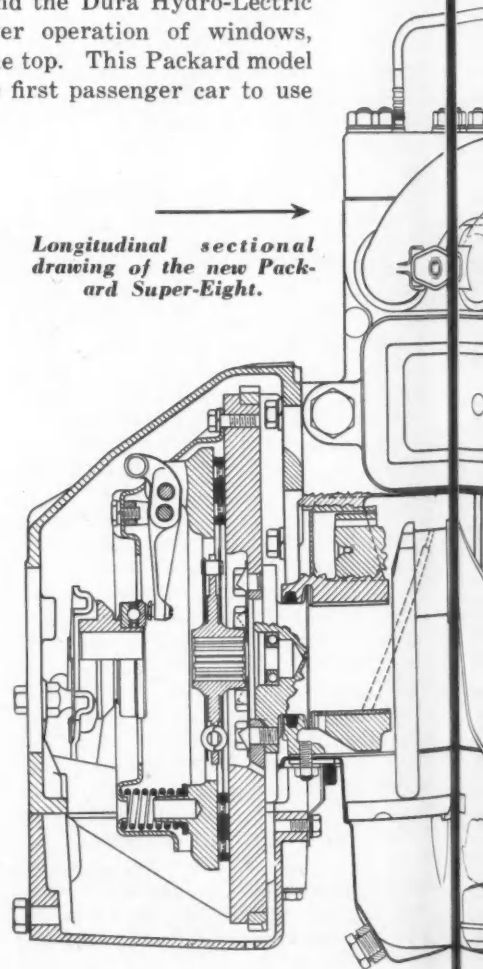
Left side of Packard Super-Eight engine. In anticipation of ignition shielding requirements for prevention of interference of television reception, Packard has mounted the ignition coil on the engine. This reduces the length of the high tension lead, and permits a better spacing of high and low tension leads.

FEATURED on the 1948 Packard Super-Eight Convertible, preliminary announcement of which was made in the April 1 issue (page 17) of AUTOMOTIVE and AVIATION INDUSTRIES, is an entirely new 145 hp engine and the Dura Hydro-Lectric system for power operation of windows, front seat and the top. This Packard model is said to be the first passenger car to use

Longitudinal sectional drawing of the new Packard Super-Eight.



Dynamometer test curves of the Packard Super-Eight engine (22nd series).



es of the

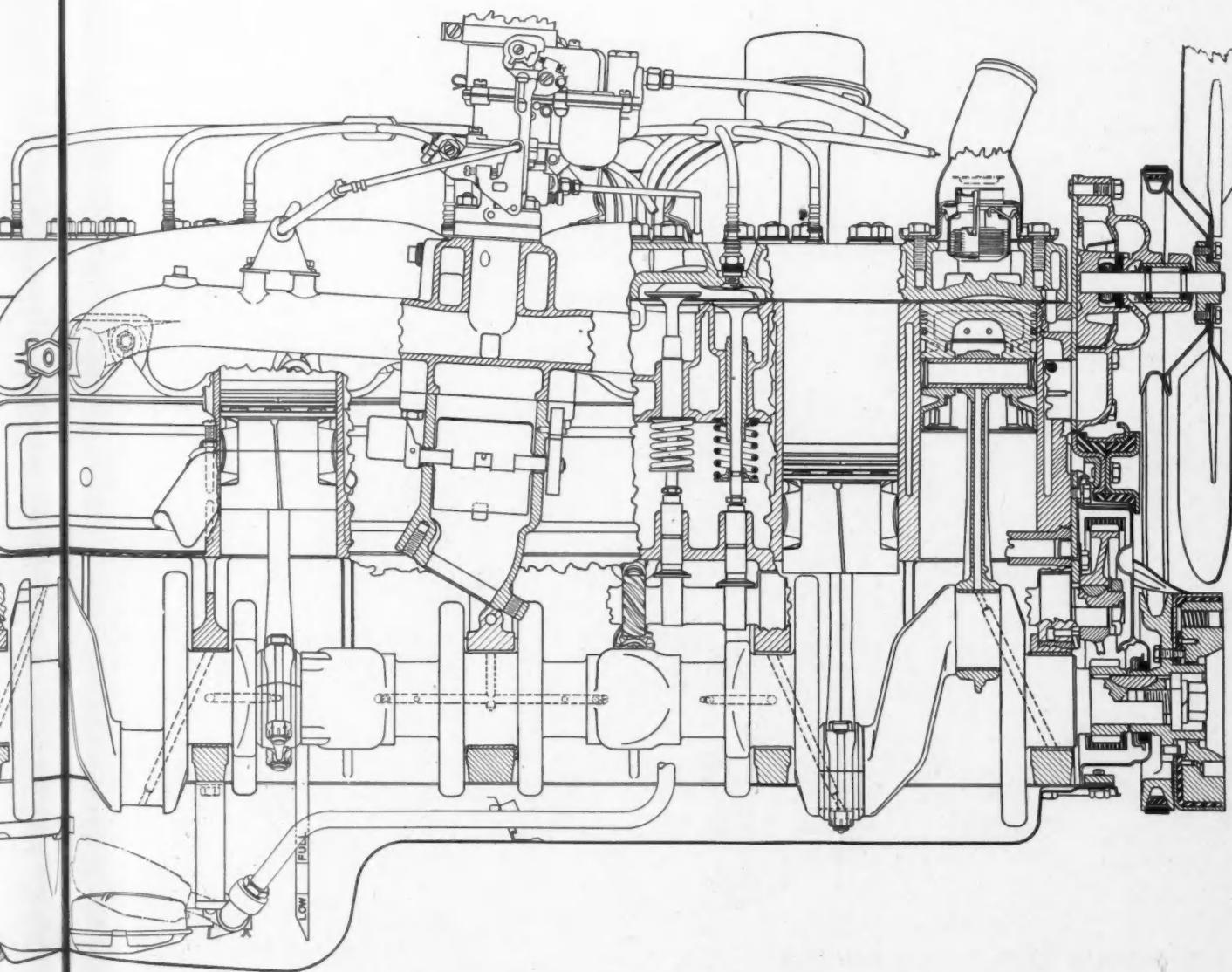
3 Packard Convertible

such power operation in all of these applications.

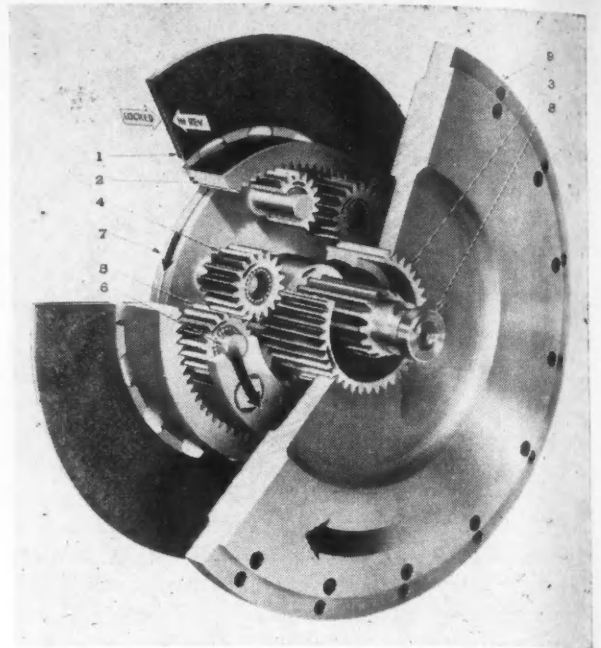
The new engine, specifications of which are given in the accompanying table, uses a five-bearing crankshaft, with main and connecting rod bearings either Moraine Durex or Federal-Mogul H-24. The latter is a lead-tin alloy, plated to a thickness of about 0.001 in. over a sintered copper-lead steel-back base. The camshaft is of pearlitic malleable iron with high-lift cams arranged for valve overlap, similar to the Custom-Eight model. Cylinder head gaskets are interchange-

able with Custom-Eight, but the cylinder head on the new engine has a different combustion chamber form in keeping with the 7.00 to 1 compression ratio. Pistons and piston rings are also interchangeable with other 3.50 in. bore engines in the Packard line. Another feature is a level intake-manifold floor parallel with the ground. Valve guides are coated with Parco Lubrite to provide an excellent bearing surface for the valve stem. Electromatic drive or overdrive or both

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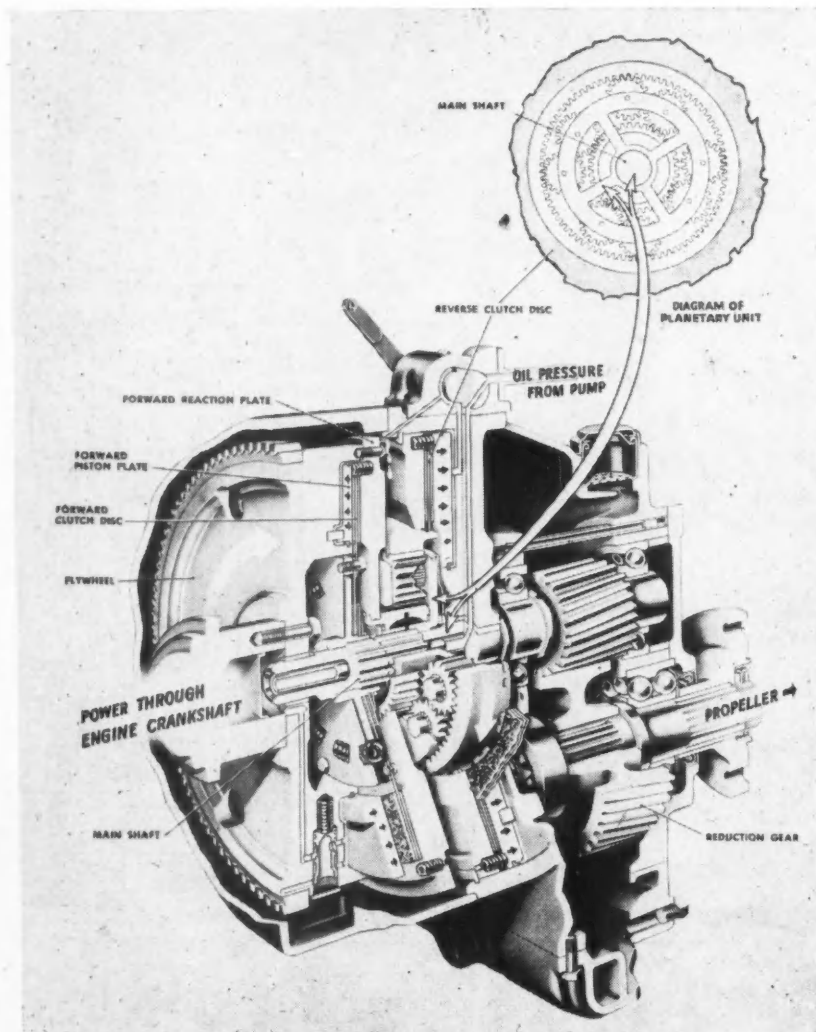


New GM Hydraulic Reverse Gear



Gear train drawing of planet and reverse drive. The numbers show:

- | | |
|-------------------------|----------------------------------|
| 1. Plate-reverse clutch | 7. Carrier-planet gear |
| 2. Ring gear | 8. Reverse gear drive shaft |
| 3. Sun gear | 9. Forward clutch reaction plate |
| 4 and 5. Planet gears | |
| 6. Shaft-planet gear | |



Cutaway view of GM hydraulically actuated reverse and reduction gear

THE new General Motors hydraulically actuated reverse and reduction gear now in production at the Detroit Diesel Engine Division has been designed as an integral part of the Series 71 marine Diesel engine in that the engine flywheel is employed as a component part of the gear mechanism. Details of this new mechanism are shown on this page. Savings in weight up to 40 per cent and in size up to 50 per cent are said to have been accomplished in the hydraulic gear over gear types previously offered. The combined flywheel and forward shifting mechanism occupies approximately the same space as the conventional flywheel. One of the features of the new gear is the ease with which the shifting mechanism can be actuated. Only a pressure of $7\frac{1}{2}$ lb is required to move the 4-in. shifting lever from the forward to reverse position.

These General Motors Diesel marine propulsion power plants are available with the new gear in 3, 4, and 6-cyl units, or as Twin-6 and Quad-6 multiple engine combinations rated up to 800 hp. Either right or left-hand rotation is offered with all
(Turn to page 86, please)

New Instruments



This new hardness tester developed by U. S. Steel research engineers is based on millionths of an inch measurements.

Hardness Tester of Microscopic Steel Grains

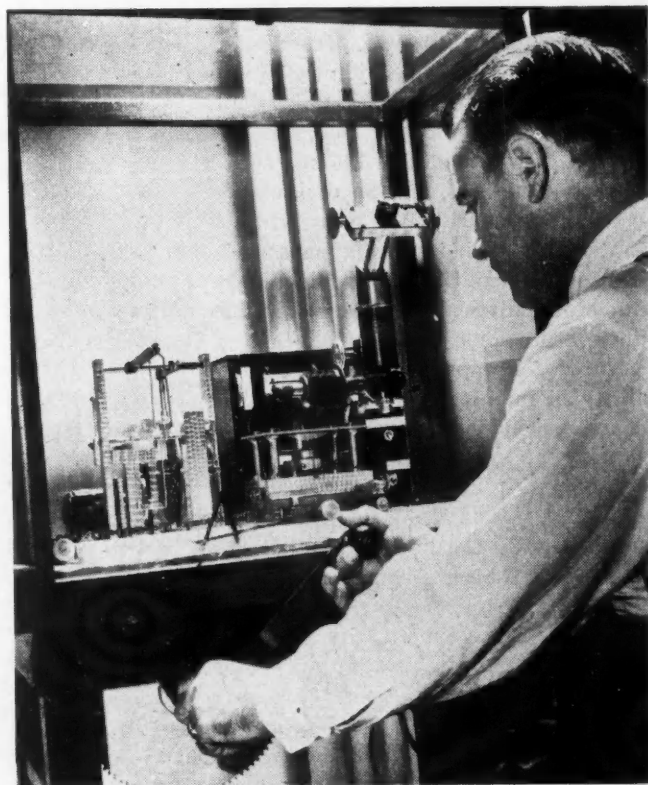
A new hardness tester, developed by the Research Laboratory of the U. S. Steel Corp., can measure the hardness of microscopic grains of steel, and thus permit the study of hardness gradients within areas too small for a satisfactory exploration with any of the usual hardness testers. This device operates by indenting the polished surface of a steel sample with a diamond-point penetrator under a load of a few grams. The diagonals of the tiny square indentation are measured in microns, and this reading related to the load placed on the penetrator.

The mechanism, shown in the accompanying photo, consists of the indenter with a square base diamond pyramid penetrator, the mechanical stage for holding the specimen, a microscope capable of magnifying the test field 500 to 1500 times, and a control box. All parts are assembled on a heavy cast iron plate supported by steel legs which rest on insulated wooden blocks to minimize effects of vibrations present in the building. As many as 60 indentations may be made automatically at predetermined time intervals for surveying tiny gradients, which may have an important influence on the behavior of a fabricated product such as a weld.

In preparing a piece of steel for testing, the
(Turn to page 74, please)

Electronic Micrometer

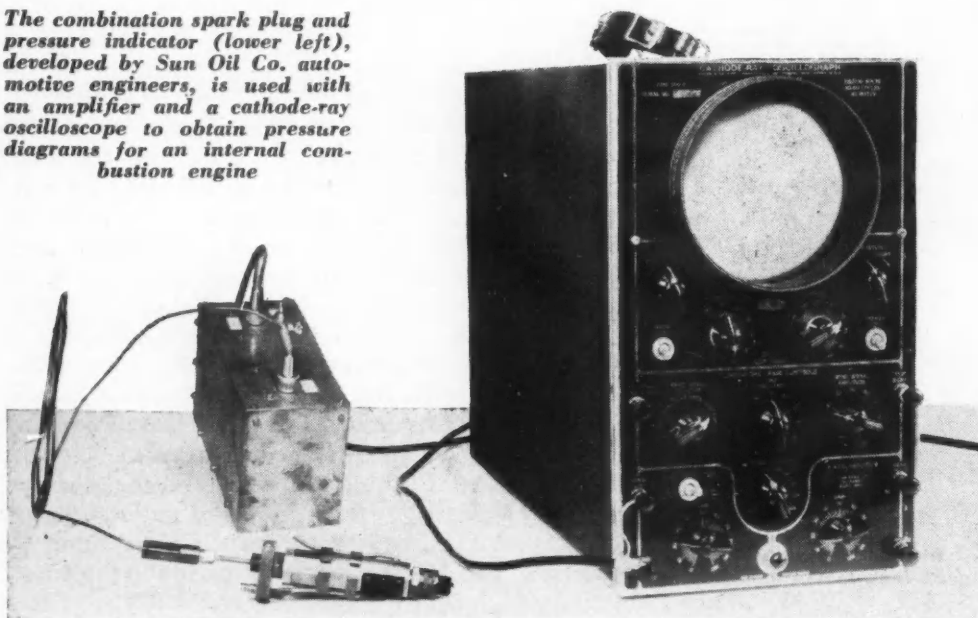
An electronic micrometer, developed by the National Bureau of Standards, makes use of the magnetic field distribution about a coil excited by high frequency currents in the presence of a metallic plate. As shown in the photo, the instrument consists of a small black cylinder containing a pick up coil and a radiating coil. The radiating coil is fed a high-frequency current. When the micrometer is held at some distance from any metallic object, the field from the radiating coil induces voltage in the pick-up coil. This induced voltage, the amount of which depends on the distance between the pick-up coil and the metallic object, is measured on the meter which is calibrated in thousandths of an inch. Readings to 0.0001 in. can be obtained. In addition to being used as a micrometer to measure the thickness of materials, another application of the device is as a tachometer.



Electronic micrometer.

New Pressure

The combination spark plug and pressure indicator (lower left), developed by Sun Oil Co. automotive engineers, is used with an amplifier and a cathode-ray oscilloscope to obtain pressure diagrams for an internal combustion engine



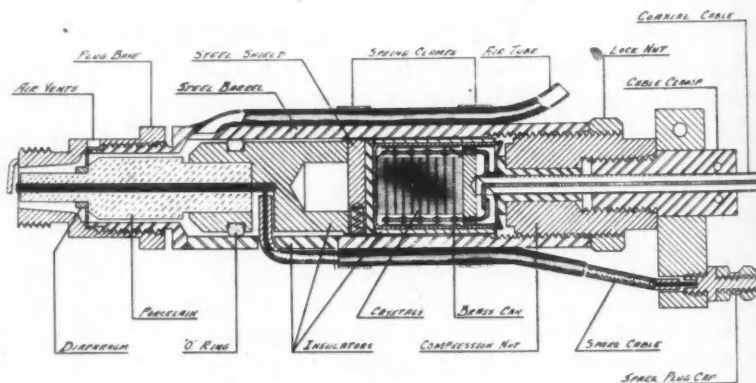
By
F. M. Mayes
and
M. A. Lindeman

Physical Research and
Development Laboratory,
Sun Oil Co.

Fig. 1—Cross-section drawing of the spark-plug pressure indicator

A PIEZOELECTRIC type pressure indicator, developed jointly by the Automotive Laboratory and Physical Laboratory of the Sun Oil Co., utilizes a modified 14 mm spark plug, an amplifier, and an oscilloscope to obtain pressure data on an internal combustion engine. The apparatus is sufficiently sensitive to provide large indicator diagrams under engine idling conditions, and can be battery operated for applications where portability is important. The spark-plug pickup or indicator can be easily installed in stock engines.

The spark-plug indicator, illustrated in Fig. 1, consists of a standard spark plug which has been modified to contain an annular diaphragm, a crystal stack, and an air tube system for cooling. Pressure variations are transmitted to the crystal stack through the spark plug porcelain with its annular diaphragm. The flexible annular diaphragm with sleeve is machined from solid stock and lapped for positive gas sealing at both the metal and porcelain seats. Porcelain cement is used at the porcelain-to-diaphragm seal. A standard spark-plug cap is mounted on a plastic support arm at the top of the indicator. The high voltage cir-



cuit to the center electrode is completed by a coaxial cable with the shield removed for about an inch at each end to prevent spark leakage.

To provide the desired sensitivity and internal capacitance, 10 X-cut quartz crystals are stacked inside a metal can. Leads are so arranged that by using seamless tube covered coaxial cable and a thin diaphragm can cover, the crystals are tightly sealed. Spark interference is eliminated by using machined plastic cylinders around the crystal can and coaxial cable to insulate the ground and shield of the crystal-stack from the spark ground return. Additional shielding is provided by the steel barrel and disc around and below the crystal can insulators respec-

Indicator Design

Piezoelectric type indicator combined with spark plug

tively. With this ground insulation and shielding, the spark pulse is barely distinguishable on the indicator diagrams.

To keep a uniform crystal temperature and to prevent overheating of the diaphragm at continuous full throttle operation, cooling air is supplied around the porcelain and exhausted through radial holes just above the diaphragm. An 'O' ring seal prevents air leakage past the crystal stack. The static pressure on the crystal due to the cooling air does not affect the calibration. By replacing the plastic parts under com-

pression with porcelain, the entire indicator could be used at higher temperatures. However, for light loads on standard automotive engines, no cooling air is required. The

crystal stack in its can tightly sealed to the cable is an integral unit of high sensitivity and can be used in other adapters for dynamic pressure measurements.

The spark-plug indicator does not pick up high-frequency pressure pulses or detonation because of the mass of the porcelain and plastic parts. By using the crystal stack unit in an adapter which permits the crystals to be close to the detonating region in a combustion chamber, a combined pressure and detonation pattern can be obtained. Commercial detonation indicators may be more satisfactory for studies of detonation phenomena alone.

The amplifier circuit, shown in Fig. 2, was designed to couple the crystal stack to a Dumont type 208-B oscilloscope. It uses a cathode follower input to provide the required high input resistance, and a single-stage amplifier to effect an overall gain of approximately 20. The $0.001 \mu\text{f}$ input capacitor is necessary to extend the low frequency response to 2 cps, and to reduce insulation resistance requirements. This input condenser may be omitted for applications where extremely high sensitivity is required and low frequency response is not important. The amplifier with its battery power supply is enclosed in a brass box for shielding. Coaxial connectors are used for input and output cables. A battery life of approximately 30 hr is ob-

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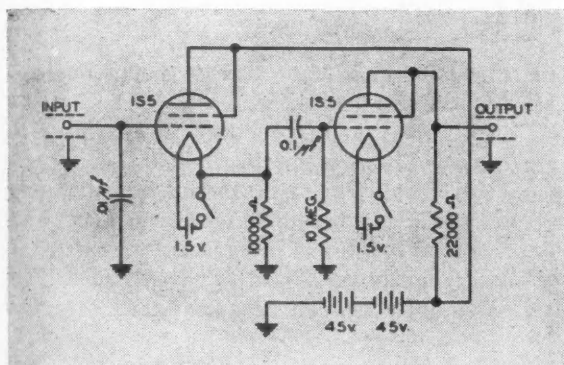
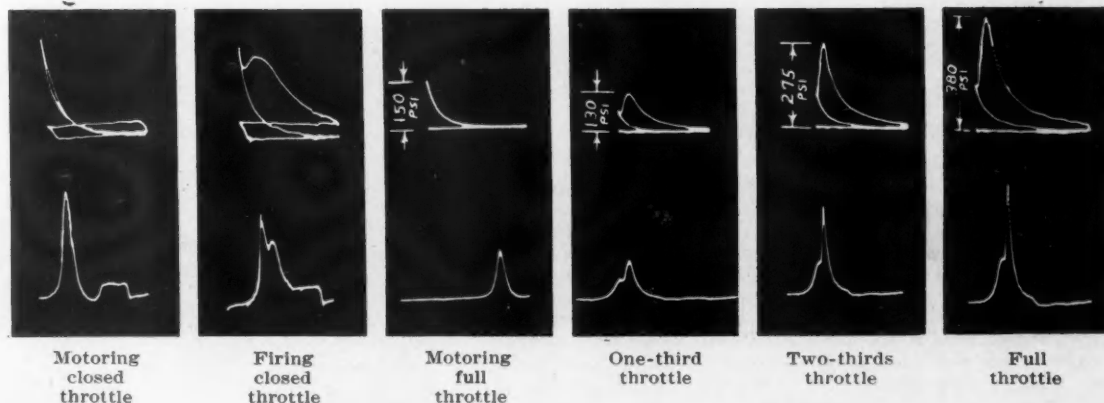


Fig. 2—This circuit diagram of the amplifier shows how the crystal stack is coupled to the oscilloscope to provide single-stage amplification of the pickup signal

Fig. 3 — These pressure - volume and pressure-time curves were obtained with a 1946 six-cylinder Ford engine with a 7.5 to 1 compression ratio operating at 1000 rpm with a two-degree spark advance

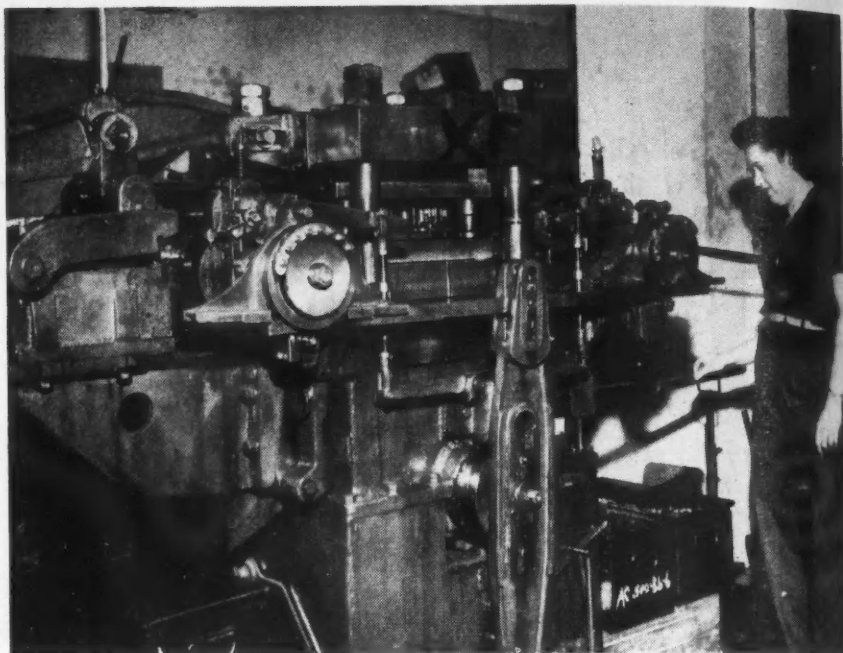


In the press shop is this new Henry & Wright dieing machine which has been tooled for long run production of laminations

IN dealing with precision made electro-mechanical accessories the problem of relatively short runs with its consequent high cost levels makes it imperative to achieve a maximum degree of interchangeability of at least the major sub-assemblies going into a family of units. This has been recognized as a basic principle of operation by Lear, Inc., of Grand Rapids, Mich., who has produced large quantities of electro-mechanical devices for actuation of elements of aircraft.

Today the company is set up to produce a variety of such items not only for aircraft installation but for industrial applications as well.

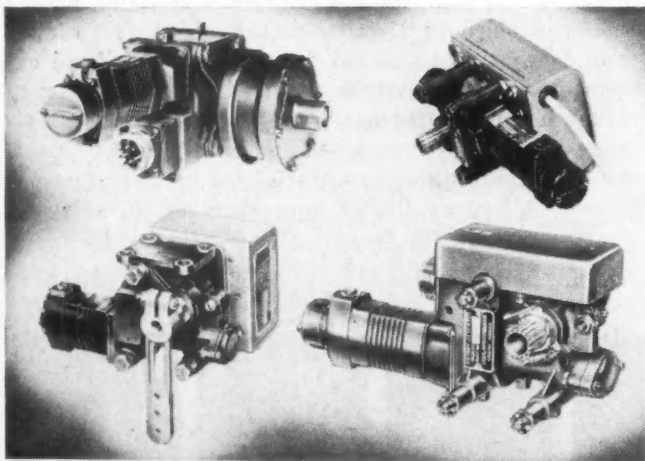
For those who may not be familiar with Lear accessories, it may be of interest to note the following general line of electro-mechanical units made here: Linear actuators, rotary actuators, power units, screw jacks, motors, controls, flexible shafting and accessories, and friction drive servo actuators. The last item is new in the line and represents a commercial version of servo actuators originally developed as part of the C-2 automatic pilot built during the war. It is a compact electrical power package using opposing friction drives to



Lear

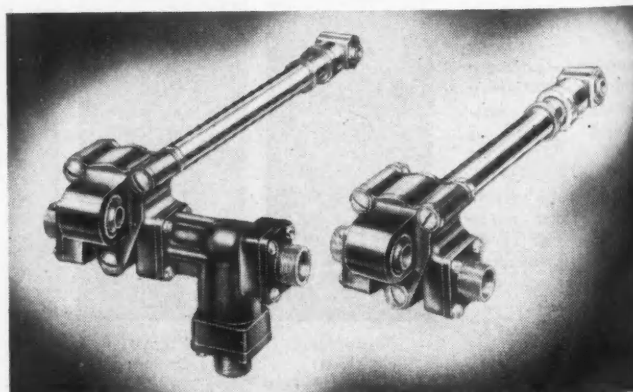
give continuously variable, smooth output power, controllable by electrical means.

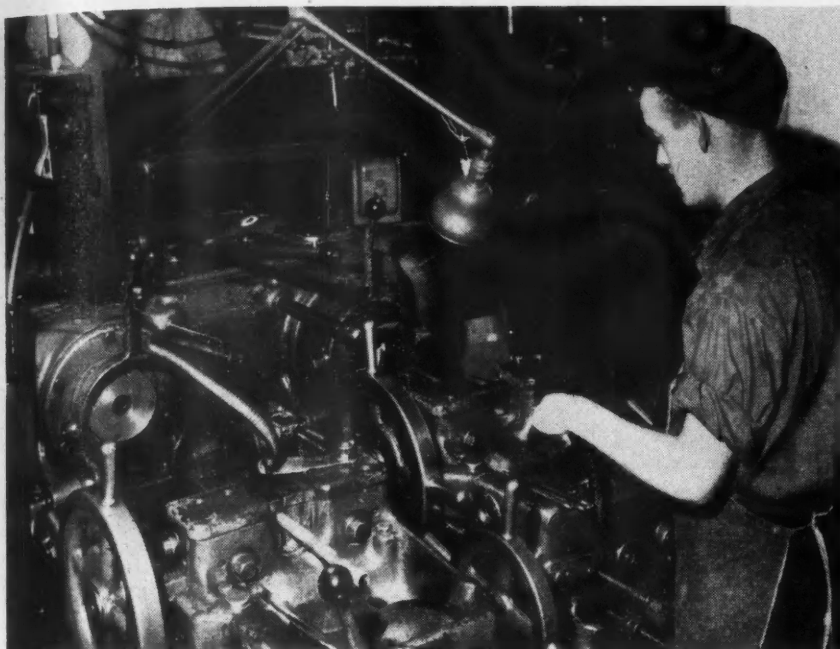
While such units can be produced in enormous variety and designed to meet specific installation and control requirements for aircraft and industrial use, it is obvious that reasonable cost levels can be attained only through the integration of special assemblies from standardized sub-assemblies. The closer this objective can be approached the lower



This "family grouping" of Lear power units stems from the basic unit at the lower right of the illustration above. This unit incorporates two limit switches. An output electro-magnetic disconnect clutch arrangement was added to the output drive (upper right), while the device at the left shows the basic unit with a control box which incorporates Automatic Temperature control, and a shorter motor, and while the unit in the upper right has a switch control box for switching to three predetermined positions or any intermediate position

An example of Lear interchangeability practice is found in the illustration below. Here the basic screw-jack, at the right, has been converted into another type of application by the addition of a "T" drive at the left. Length of torque tube and type of end fitting also can be varied. This principle is applied to all products in the Lear line in the interest of flexibility of design and production detail





One of the unique uses of this two spindle Landis Threadmatic is the production of multiple-lead screws in lengths of ten ft or more

By
Joseph
Geschelin

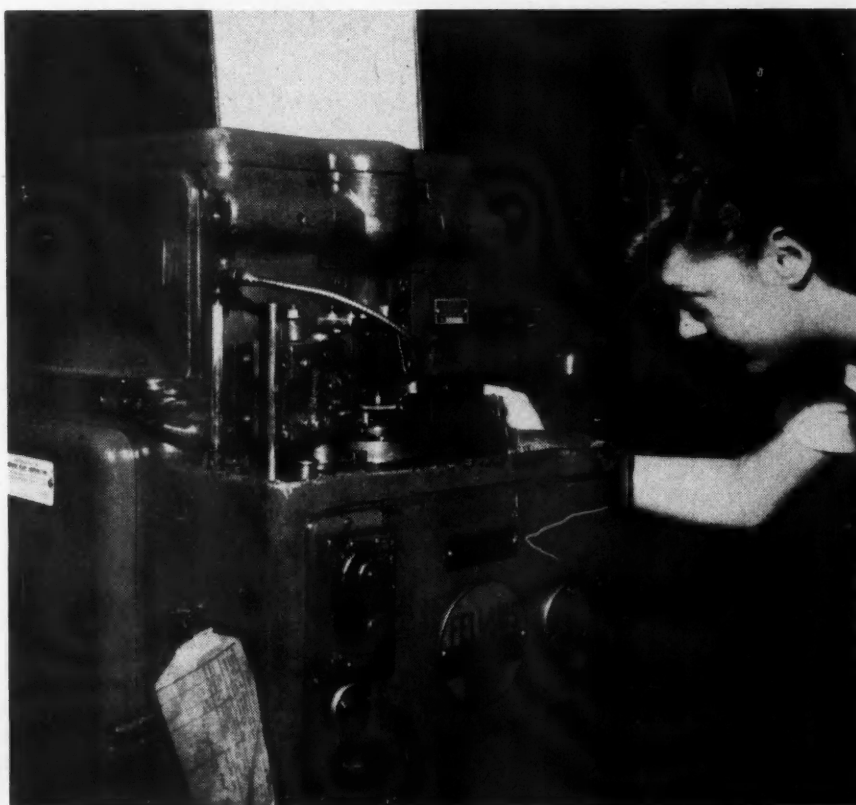
Solves Short Run

Problem for Electro-Mechanical Accessories

will be the cost to the user. Custom building on a small scale would defeat the purpose and sharply reduce market possibilities.

Consequently, the engineering approach is to study existing applications as well as all new products from the standpoint of utilizing as much as they can of the major elements such as motors, gear housings, torque tubes, clutches, and other parts. This program in its full development assures the ability to increase the size of runs on many standard parts, to reduce tooling costs, and, in general, leads to a

(Turn to page 82, please)



The size of gear cutting machinery is scaled down to suit the tiny gears made at Lear. This is one of the new Fellows High Speed gear shapers

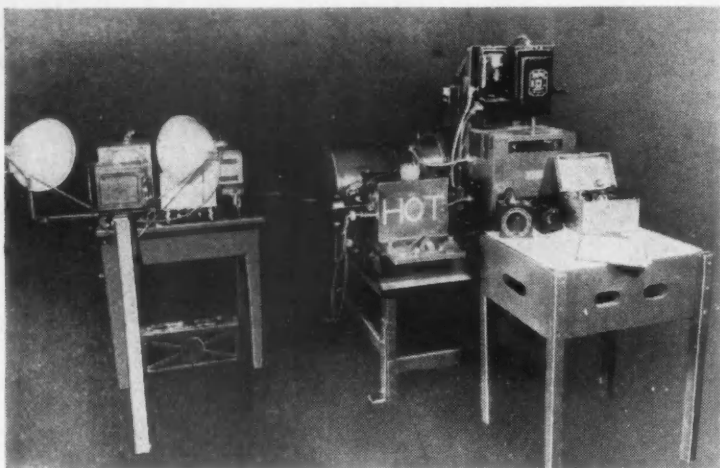


Fig. 1—This photo shows the complete assembly of the Buick engine mount testing machine. The photographic recorder and oscillograph are at the left

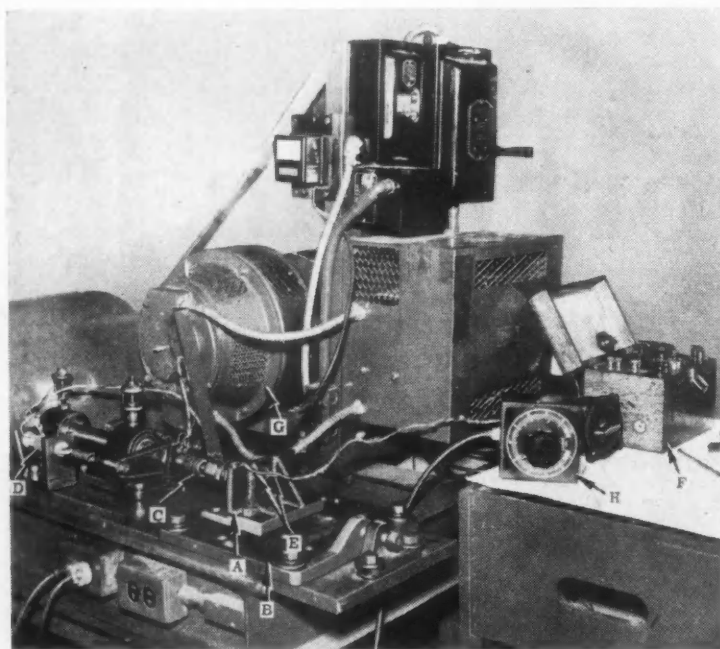


Fig. 2—Closeup of the mechanical stroking equipment and instrumentation. The engine mount under test is held by bracket A

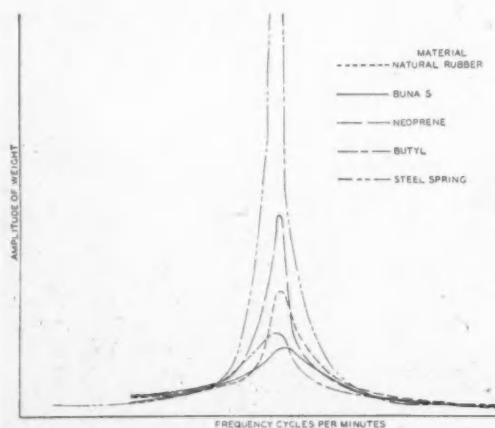


Fig. 3—Damping effect of various elastic materials as obtained with Buick machine

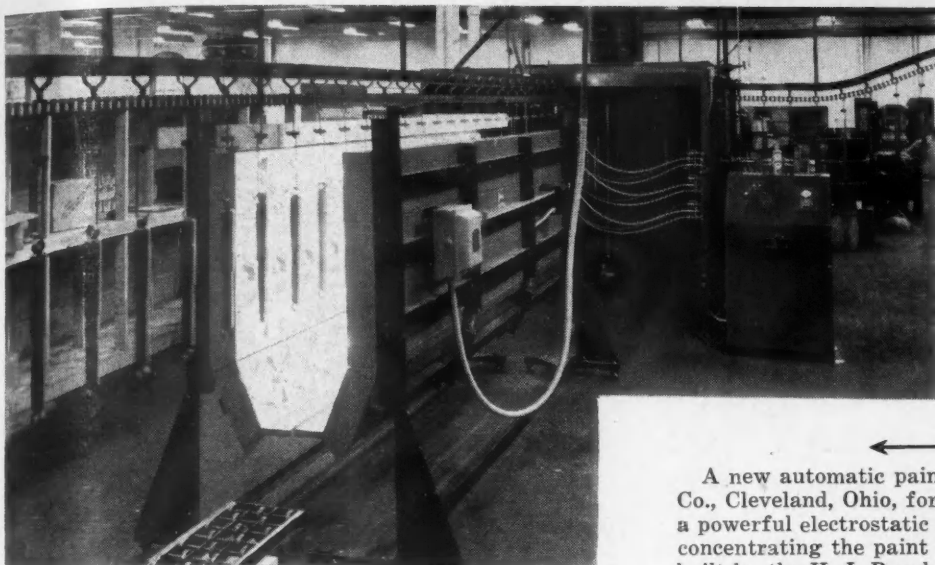
Unique Machine Tests Engine Mount Materials

BUICK MOTOR DIVISION, General Motors Corp., has developed a unique machine to test elastic materials for engine mountings. It measures the rate, hysteresis loss, and efficiency of a mount; and, under dynamic loading conditions, it can be used to evaluate life expectancy.

As illustrated in Fig. 1, this machine consists of three major assemblies: the mechanical stroker in which the mount is studied; a strain-gage recorder at the right; and a specially designed photographic recorder at the left. The mechanical stroker, Fig. 2, contains a variable speed motor which is arranged to drive a variable stroke eccentric. The latter applies a definite deformation to the mount through a connecting rod and drive rods. Referring to Fig. 2, at A is a bracket for holding the mount; B is a movable plate for preloading the mount; C is the load-recording tube to which are cemented the strain gages; D is the stroke-recording tube, also containing strain gages; at E are located the thermocouples for measuring mount and ambient air temperatures, recorded on potentiometer F. The drive motor and its control are indicated by G and H respectively.

The strain-gage recorder includes a load-recording tube on which are mounted the Baldwin-Southwark wire strain gages. These gages are connected to a cathode ray oscillograph through suitable amplifiers. During the course of a test, readings produce a characteristic hysteresis loop on the oscillograph screen, which may be observed visually for quick analysis and photographed for further study. The photographic recorder, at the extreme left of Fig. 1, is used to make a permanent record of the hysteresis loop. These records are analyzed later in the graphical solution of the rate, input and output work, and efficiency of the mount.

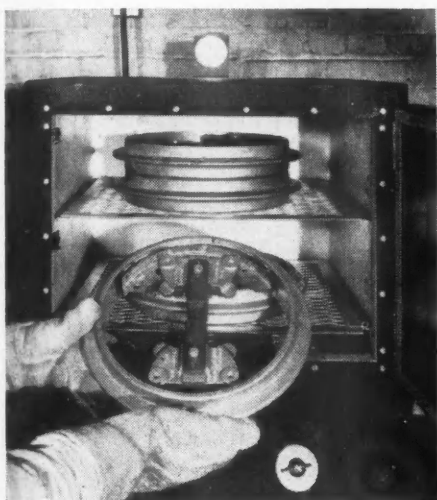
(Turn to page 74, please)



Electrostatic Method Applied to Shock Absorber Painting

A new automatic paint spray booth, used by the Gabriel Co., Cleveland, Ohio, for finishing shock absorbers, utilizes a powerful electrostatic field for removing excess paint and concentrating the paint within a limited area. This booth, built by the H. J. Ransburg Co., is shown in this photo beyond the rear of the drying oven. The electrostatic field, inside the booth, is contained within two screens about the monorail conveyor. Shock absorbers, hung on the overhead conveyor at an outside station, are carried through the field and sprayed by a group of automatically controlled guns. The conveyor rotates the shock absorbers during the operation in order to present their entire periphery to the spray guns. After leaving the booth, the shock absorbers pass through a Fostoria infra-red lamp tunnel for baking.

New Methods

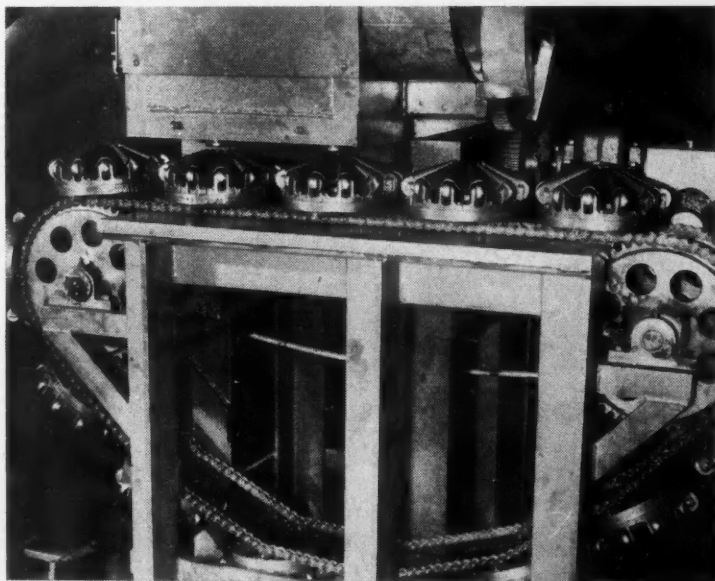


Brake Lining Bonded to Shoes

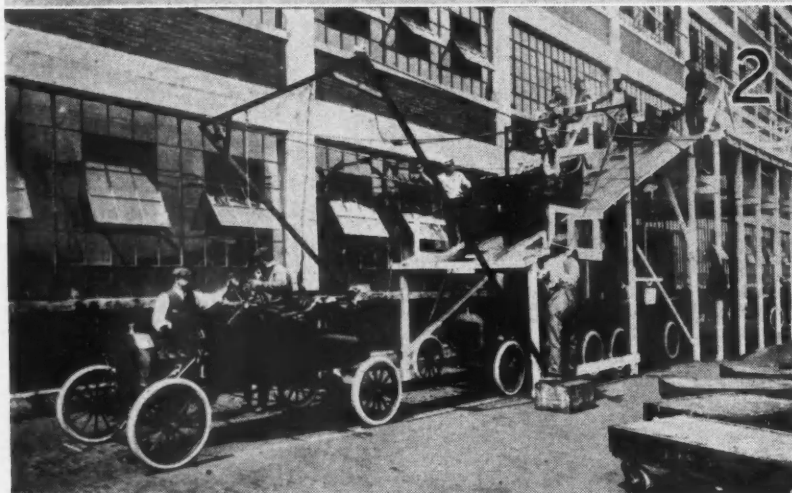
By means of a new process developed by Goodyear Tire and Rubber Co. relining of motor vehicle brakes is done in its dealer service departments by bonding the lining to the shoes by a special cement. Shoe and lining, installed under pressure in a specially designed ring and spreader, are placed in this Trent thermostatically controlled and automatically timed oven for curing the bonding cement. At present bonded brake linings are installed by Dodge on its light trucks and other automobile manufacturers are experimenting with them. Compared to the rivet method, Goodyear claims six to nine times greater bonding efficiency.

Buick's New Spring Setup

ALTHOUGH dished clutch springs have been used by Buick for many years it is only recently that the company has undertaken their manufacture. Shown here is a unique machine for pre-setting springs as the final operation in the production process. Each spring is flexed from its position at rest to $\frac{1}{2}$ in. below flat position through loading by means of press ram above the table. Work is flexed six times through this range, producing a stress beyond the maximum expected in service. Combination of shot-peening before pre-setting followed by pre-setting is expected to assure freedom from fatigue failure for the life of the vehicle.



Henry Ford—The Man



1

Birthplace of the first Ford "horseless carriage" in 1896 at 58 Bagley Ave., Detroit, Mich. This photo shows an exact replica of the original workshop in the little brick shed where Henry Ford began his engine experiments in 1893 during "off hours."

2

Mass production in its early stages during 1913 at the Highland Park plant. For the body drop, bodies were skidded down the wooden ramp and lowered on to the chassis. By Dec. 10, 1915 the 1,000,000th Ford car had been built.

3

Henry and Edsel Ford in the 15,000,000th Ford car, among the last of the Model Ts built, on May 26, 1927 just after it rolled from the final assembly line that day.

4

Henry Ford, race driver, at the beginning of the Twentieth Century.

The Ford

1863, July 30—Henry Ford born Springwells Township farm, Wayne County, Michigan, son of William and Mary (Litigot) Ford.

1881—Becomes apprentice in Detroit machine shop, works at night as watch repairer in Baker street jewelry shop.

1888, April 11—Marries Clara J. Bryant of Greenfield township.

1889-1890—Begins experiments on internal combustion engines.

1891-1892—Hired by Edison Illuminating Co., Detroit. Completes "double-cylinder" engine.

1893, Nov. 6—Son, Edsel Bryant Ford born.
Dec. 15—Moves to 58 Bagley Ave.

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DUSTRIES

His Achievements

5

The sweeping Rouge plant in Michigan—heart of the Ford industrial empire with a vast network of manufacturing plants, branch assembly plants and sales outlets throughout the nation. Since the Ford Motor Co. was founded in 1903, close to 32,000,000 cars and trucks have come off its assembly lines, one-third of the total output from the nation's automobile factories since 1900.

6

His inspiration—the children. He learned more from them, he often remarked, than they did from him.

7

Ford turns to the land. His early tractor experiments began about 1913.

8

Henry Ford reflects on the past in 1946. Nearing the end of a bountiful career, having retired from the presidency of the Ford Motor Co. the previous year, he sits in the first car he built in 1896.

Chronology

- Dec. 29—Begins work on new two-cylinder gasoline engine.
- 1896—Completes first of a series of 25 cars at 58 Bagley Ave.
- 1899, Aug. 15—Resigns from Edison Illuminating Co., and helps organize Detroit Automobile Co.
- 1901—Adopts steering wheel to replace tillers.
- Oct. 10—Defeats Alexander Winton in Grosse Pointe auto race, driving two-cylinder car.
- 1902, Oct. 25—In Ford's racing car "999", Barney Oldfield wins Diamond Trophy on Grosse Pointe Track. (Next page please)

May 1, 1947



Nov.—Begins organizing Ford Motor Company.

1903, May—Moves to Mack and Belt Line.

June 16—Articles of incorporation filed in name of Ford Motor Company, a Michigan Corporation, 12 stockholders, capital stock \$100,000. (Only \$28,000 paid.) Henry Ford is vice-president.

July 23—Company sells first car, two-cylinder, first Model "A".

1904, Jan. 12—Ford, driving his "Arrow" race car, sets world's auto speed record, 92 miles an hour, on Lake St. Clair ice.

Four-cylinder car, Model "B", Model "C", and Model "F" introduced.

Torque Tube Drive adopted.

1905—Company moves to Piquette and Beaubien.

1906—Ford succeeds John F. Gray as president of company.

Model "N" four-cylinder car in production.

Six-cylinder car introduced. 40 hp. Model "K".

Model "S" four-cylinder car introduced.

Model "R" four-cylinder car introduced.

1907—Farm tractor with copper-jacket-engine built at Piquette plant.

Fin and tube radiator, replacing the cellular type, adopted.

Removable cylinder head introduced.

1908, Oct. 1—First Model "T" introduced.

Vanadium steel first used.

First bonus paid by company.

Closed models, town car and coupe introduced.

1909, June 1—Start of transcontinental race, New York City to Seattle. Won by Model "T" in 22 days.

June—100 cars built in a single day.

December—Company moves to new Highland Park plant.

1911—First endless floor conveyor and chain installed.

Dagenham, England, plant established to build complete cars.

1913, March—Sociological Department started.

1914, Jan. 12—Minimum wage of \$5 a day introduced, and eight-hour working day established. Employees' profit sharing plan effective.

April 16—Model "T" sedan, introduced.

1915, July—Rouge plant property acquired.

Oct. 1—Henry Ford hospital opened.

Dec. 10—1,000,000th Ford car built.

Coach-type body introduced.

1916, Oct. 25—Henry Ford Trade School opened.

1917, Jan. 27—First tractor sent to England.

Builds first Liberty engine.

April 1—Start Rouge dock construction.

Oct. 8—Tractor production begun at Dearborn.

1918, July 11—First Eagle Boat launched.

Government leases Henry Ford Hospital at the rate of \$1 a year.

1919, Jan. 1—Minimum wage of \$6 a day effective.

Jan. 1—Edsel B. Ford succeeds Henry Ford as president.

Jan. 1—Tractor production started at Cork, Ireland.

Henry Ford and Edsel Ford become sole owners of company.

1919, July 9—Delaware Corporation organized with Henry Ford, Edsel B. Ford and F. L. Klingensmith as directors. Capitalization \$100,000,000.

Oct. 17—Coke ovens in operation.

Demountable rims and self-starter adopted.

1920, Jan. 1—Employees receive substantial bonus, 10 per cent of wages.

May 17—"Henry" Blast Furnace lighted.

The Ford Chronology

Continued

Oct. 21—Integral brake drums and wheel hub replaces stamped metal drum and malleable hub.

Dec. 23—First casting poured in production foundry.

1921, Jan. 1—Employees given another 10 per cent bonus.

Feb. 23—Tractor production started at Rouge plant.

May 28—5,000,000th Ford car built.

1922, Feb. 24—Lincoln Motor Company purchased.

1923, July 11—First steamer up the Rouge River.

Aug. 11—First glass rolled in glass plant.

1924, June 4—10,000,000th Ford car built.

Sept. 30—First motor built in Motor Building.

1925, Jan. 10—Dearborn Engineering Laboratory opened.

Jan. 15—Ford Airport dedicated.

April 13—Operation of Ford Airlines begins.

Aug. 1—Building of airport and mooring mast begun.

Oct. 31—Record production of 10,000 Model "T" cars in one day.

1926, Jan.—Ford adopts five-day, 40-hour week.

Jan. 17—Fire destroys original airplane plant.

Jan. 21—First open hearth poured.

July 30—"Flivver" airplane makes test flight at Dearborn Airport.

Dec.—Start erection of Greenfield Village and Edison Museum.

1927, Feb. 10—First radio range system guides Ford plane from Dearborn to Dayton.

1927, March—New airplane plant completed.

May 26—15,000,000th Ford car built.

Oct. 20—First new "Model A" built.

Nov. 1—Final car assembly in operation at Rouge.

Nov. 1—Laminated safety glass becomes standard equipment.

Dec. 2—New Model "A" introduced.

1928, Jan. 20—Administration Building opened.

June 30—17th Annual Gordon Bennett Balloon Race started from Ford Airport.

1929, Oct. 21—50th Anniversary of Edison's Incandescent light. Edison Institute at Dearborn dedicated.

Dec. 1—Minimum wage of \$7 a day effective.

1931, April 14—20,000,000th Ford car built.

1932, Mar. 9—First V-8 Ford built.

1933, June 12—Greenfield Village opened.

1934, June 20—First millionth "V-8" built.

1935, June 25—Ford Training School for high school graduates opened.

Oct. 5—Lincoln-Zephyr production started.

Nov. 19—Start of Detroit Symphony broadcasts.

1936, May—Ford Foundation established.

Aug. 13—Soy Bean plant in operation.

Nov. 6—First Ford dealer Convention held. 8,000 attend.

1937, Jan. 18—25,000,000th Ford car built.

July 30—First Ford tire manufactured.

Ford builds transit type busses—front engine drive. Model "70".

1938, May 5—Five millionth "V-8" built.

July 30—Mr. Ford's 75th birthday celebrated at Ford Field.

Oct. 8—Mercury production started.

Dec. 19—Henry Ford II elected a director of the company.

Cab-over-engine truck introduced.

1939, Feb. 15—27 millionth Ford car built.

May 1—Six millionth "V-8" motor built.

June 15—First Ford-Ferguson Tractor built at Rouge.

Sept. 1—Magnesium produced by Electro-Thermic process.

1940, April 8—28 Millionth car produced (Edgewater Branch).

June 4—7 millionth "V-8" motor built.

Nov. 20—Six-cylinder car in production.

1941, Jan. 15—U. S. Naval Training Station, Rouge Plant, dedicated.

March 1—First jeep driven off Rouge assembly line.

(Turn to page 60, please)

PUBLICATIONS AVAILABLE

Publications listed in this department are obtainable by subscribers through the Editorial Department of AUTOMOTIVE and AVIATION INDUSTRIES. In making requests please be sure to give the NUMBER of the item concerning the publication desired, your name and address, company connection and title.

A-107—Patterns and Castings

Howard Foundry Co.—An attractive brochure outlining the extensive modern facilities of the company in producing aluminum, magnesium, semi-steel, bronze and brass castings. Complete specifications tables are included for sand casting alloys, permanent mold casting alloys and die casting alloys. Also given are tables of mechanical properties of aluminum base alloys, chemical compositions and mechanical properties of aluminum and magnesium alloys, chemical compositions and mechanical properties of brass and bronze casting alloys. The various foundry buildings are also pictured.

A-108—Stainless Steel and The Petroleum Industry

Allegheny Ludlum Steel Corp.—New brochure entitled Allegheny Metal in the Petroleum Industry. The 36-page booklet is well illustrated with pictures and graphic charts and deals, in 12 chapters, with crude oil fields, the synthetic rubber industry, oil refining industry, cycling and natural gas, oil transportation and storage and the marketing of oil and oil products and the fabrication of stainless steel.

A-109—Man-Au-Trol Spacers

The Bullard Co.—A new 12-page booklet describing and illustrating its various spacer units, hydraulically-actuated mechanisms for precision drilling, tapping, reaming and boring of holes in metal parts without the use of jigs. A page of specifications is included for the types of spacers listed in the booklet. A 16 mm sound film, running for 27 minutes, covering the Man-Au-Trol Vertical Turret Lathe, and a 16 mm sound film, running for 14 minutes, on the Man-Au-Trol Spacer are available for showing to authorized groups. The Bullard Co. has also published a companion-piece to the booklet on spacers entitled Proved Interchangeability Without Jigs, which describes and illustrates the use of spacers without jigs.

A-110—Relays

Guardian Electric Mfg. Co.—Catalog 10-A illustrates a number of basic type AC and DC relays, including sensitive, multiple contact, etc. Charts giving operating data, contact data, also text matter on suggested applications and more detailed information on coil, contact and mounting instructions accompany each relay. Diagrams show con-

struction and dimensions of relays.

A-111—3-Way Broaching Machine

American Broach & Machine Co.—8-page color circular describes the application, operation and specifications of the complete line of type T-3-way Broaching Machines.

A-112—Automatic Electronic Inspection System

Arma Corp.—Folder showing the company's new Limitron inspection system for sorting of parts on production and assembly lines and in receiving rooms. It also serves as a brief catalog of the various component assemblies which can be combined to make the system fit the individual needs of the user.

A-113—Protective Coatings

Prufcoat Laboratories, Inc.—Catalog folder describing Prufcoat Protective Coatings. The features of Prufcoat are listed, chemical agents it resists, an interesting variety of actual case histories, as well as uses and complete application information.

A-114—Water-Mix Cutting Oil

D. A. Stuart Oil Co.—A new 4-page folder describing KleenKut, a laboratory controlled water-mix cutting oil. Typical applications are described and the proper method for mixing with water.

(Turn to page 62, please)

TIME SAVER COUPON for your convenience in obtaining, without obligation, more information on any one or more of the publications described above OR New Production and Plant Equipment OR New Products items described on following pages.

**Automotive and Aviation Industries,
Chestnut & 56th Sts., Philadelphia 39, Pa.**

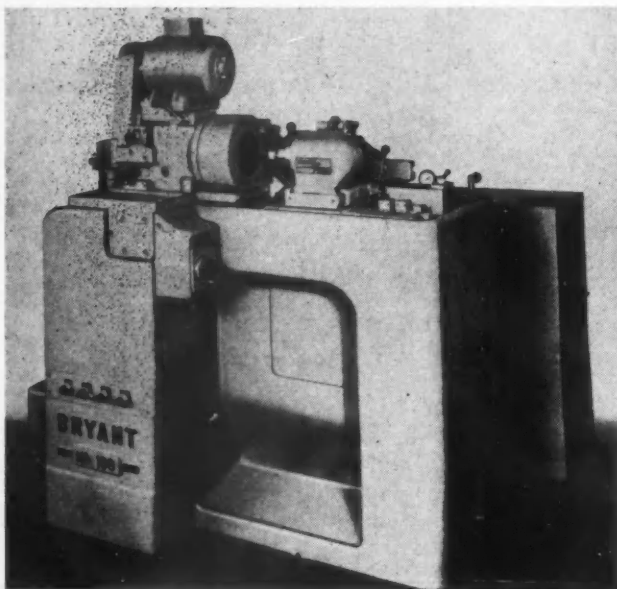
<p>Please send me: These FREE Publications (Order by Number Shown on This Page)</p> <p>.....</p> <p>.....</p>	<p>Please send me more information on: New Production and Plant Equipment (Order by Number Shown on Following Pages)</p> <p>.....</p> <p>.....</p>	<p>Please send me more information on: New Products (Order by Number Shown on Following Pages)</p> <p>.....</p> <p>.....</p>
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Your Name Your Title

Your Company Connection or Business

Address
(Street & No.) (City) (Zone) (State)

NEW Production and Plant EQUIPMENT



*Bryant automatic
internal grinder
No. 109*

automatic internal grinder, particularly designed for the high production grinding of bore diameters from $\frac{1}{4}$ in. to 3 in., up to 4 in. deep. Designated the No. 109, the new grinder will swing work up to 9 in. and is suitable for such jobs as ball bearing races, gears, rolls, bushings and other small parts which can be produced most profitably in large quantities. The most important feature of the new 109 is the comprehensive hydraulic and electronic control arrangement that provides for completely selective, infinitely variable cycles.

The machine is designed so that the full grinding cycle proceeds automatically and operator attention is required only for loading and unloading the work and tripping the valve to start the cycle. The machine then operates automatically through the following cycle—rough grind, true wheel, finish grind and return to chucking position as finish size is reached.

By providing d-c motors (built-in rectifiers allow the use of standard a-c power) to supply driving power to the cross feed and the work drive spindle, an infinite number of feeds and speeds are available.

The 109 uses the new direct-mounted Bryant high-frequency wheelhead unit. With this drive, wheel speeds up to 100,000 rpm can be attained. Provision has also been made for a balanced, belt-driven wheelhead, giving speeds from 200 to 2400 rpm.

B-14—Durable Pallets Of Plywood

As companion units for Clark fork lift trucks, durable pallets made of plywood are offered by the Clark Tractor Division of Clark Equipment Co., Battle Creek, Mich.

Constructed with $\frac{3}{8}$ -in. plywood decks and posts of plywood blocks or metal, the durable pallet is said to weigh only a little more than half as

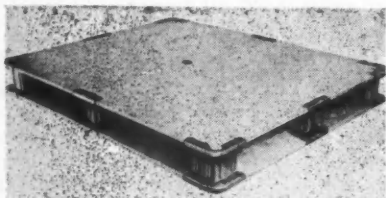
clearance weighing 89 lb. Capacities are 4000 lb carrying load, and 16,000 lb static load.

B-15—Automatic Internal Grinder

The Bryant Chucking Grinder Co. of Springfield, Vt., announces a new

B-16—Improved Broaching Machine

The American Broach and Machine Co., Ann Arbor, Mich., has made several changes in the design of its vertical hydraulic Type T-3-way broaching machine. An improvement has been made in the coolant assembly while minor changes have been made in the design of the work table. Coolant is supplied from the enlarged reservoir located in the work table base by the integral motor and centrifugal pump unit located on the side of the machine below the operating lever. Mounting is such that pumping unit can be taken out by removal of four screws and disconnecting of inlet and discharge pipes.

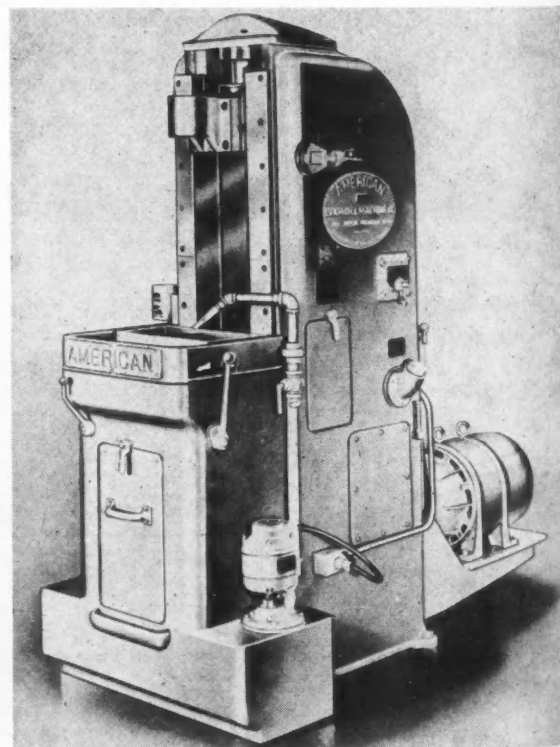


Clark plywood pallet

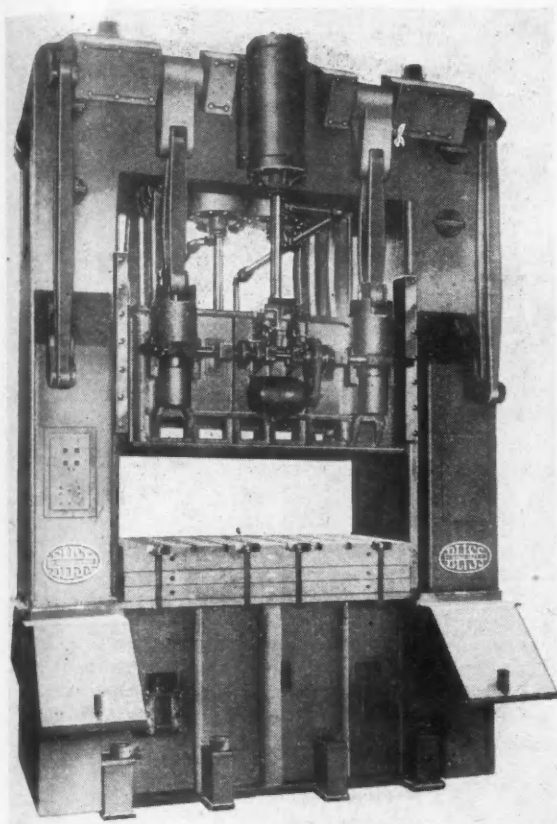
much as a comparable hardwood pallet. It is double-faced, designed for four-way fork entry, and can be furnished in the metal-post construction for use with hand-lift or motorized pallet trucks.

Among advantages claimed for this plywood pallet are its unbroken, splinterless surface which minimizes damage to the material load; ease of strapping in both directions; ease and safety of handling, both loaded and empty; and suitability for safe, firm tiering.

The durable plywood pallet is offered in sizes ranging from 30 by 40 in. with 2-in. vertical clearance and weighing 36 lb, up to 48 by 60 in. with 3 $\frac{3}{4}$ -in.



New Production and Plant EQUIPMENT



Bliss Triple Action Toggle Press

This machine is driven by a 75-hp Reliance motor directly connected through the gearing. Its total height is 367 in., of which 210 in. is above the floor line. In addition to the press illustrated, Bliss also is building two others of 700 tons capacity, which provide a similar design in widths between uprights of 134 in. and 180 in.

B-17—New Line of Toggle Presses

E. W. Bliss Company, Detroit 2, Mich., has brought out a new toggle press line for triple action drawing of large automobile stampings in a wide range of capacities and in any widths desired. These new presses have four-point suspension on both the upper slides which are accurately timed and mechanically locked with a crank-driven plunger in the bed.

The location of the driving mechanism below the bed permits a considerable reduction in the machine's height above the floor, providing a greatly lowered center of gravity as compared to that of the old-line machines. Greater stability is accomplished with increased footing front to back.

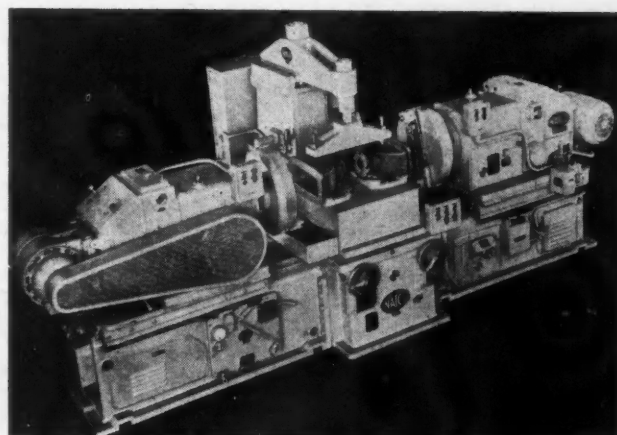
With triple geared driving mechanism, which consists essentially of motor, drive shaft, and intermediate gearing, the lower plunger is driven by two main crankshafts supported by individual crowns beneath the press bed. The main gears, mounted on the outer ends of the crankshafts, have hubs on each side which are the eccentrics, driving the upper plunger and blankholder mechanisms. Each corner of the

blankholder can be power adjusted either independently or if desired can be synchronized with the other three corners.

This system of toggle linkage gives an unusually long dwell to the blankholder; also a sufficient dwell to the upper plunger to perform redraw work with the lower slide.

The entire frame is of welded steel construction. The upper slides are counterbalanced and the lower slide is counterbalanced on all larger machines.

NATCO A20 "B"
Borface machine



B-18—Machine for Precision Boring

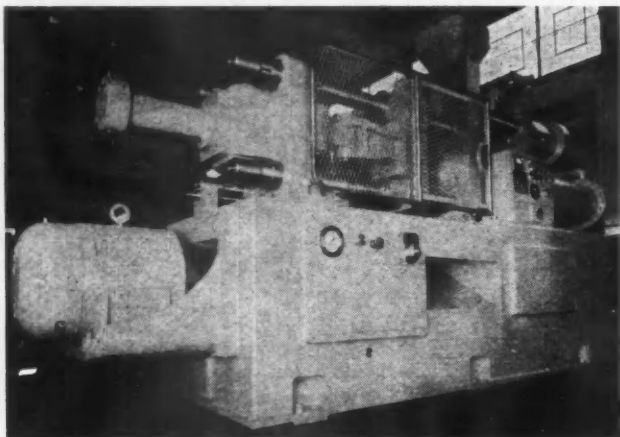
The new NATCO A-20 Borface machine was developed by the National Automatic Tool Co., Inc., Richmond, Ind., to speed production of precision boring in large hard-to-handle castings. It consists of either A-20A or A-20B Model units which may be mounted horizontally, vertically, or at an angle in fabricating multi-way type precision boring machines. The only difference between the A-20A and A-20B Model is that the "B" unit provides an automatic cross-facing drive and control which is inserted between the rear end of the spindle unit and the spindle drive motor.

All NATCO A-20 Borface units are provided with heavy-duty spindles mounted on pre-loaded precision bearings, with worm and gear driven by "V" belt drive to insure smooth flow of power to cutter bits. Model A-20 Borface units have been introduced to cover a field in large bores not previously covered by production way-type machines and make possible the speedy handling of work too large and awkward to handle or swing on boring mills and lathes. The A-20B type unit also permits operating on more than one face at a time through way-type application thereby insuring greater precision and eliminating rehandling or resetting between operations.

Various types of work heads may be employed which are designed for special work requirements. These heads may permit a combination of turning, boring, cross-facing, undercutting and other operations.

B-19—Automatic Molding Machine

The Rockford Machine Tool Co., Rockford, Ill., is introducing the Rock-



*Rockford Hy-Jector
molding machine*

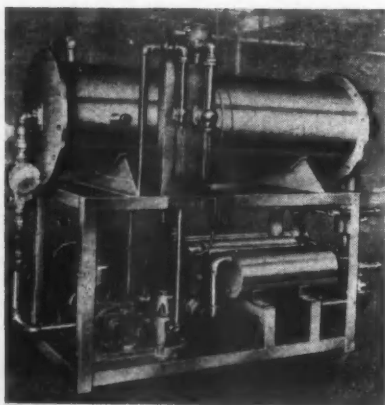
ford Hy-Jector, a fully-automatic molding machine for thermosetting plastics. The conventional three-stage production sequence, usually carried out on separate machines, is performed on this single machine.

The basic steps of making the preform, preheating, molding, and curing are all carried out by the Rockford Hy-Jector, automatically and in uninterrupted sequence. With interlocked electronic controls and timers, infinitely adjustable to meet every requirement, exact production control is said to be possible.

Once the Rockford Hy-Jector is set up, with controls set as required, operation is entirely automatic from feed of the plastic powder to removal of the finished part from the mold.

B-20—Gas Producer

A gas producer that generates a prepared atmosphere by partially burning (exothermic reaction) natural, artificial or propane gas has been placed on the market by the Bellevue Industrial Furnace Co., 2971 Bellevue, Detroit 7, Mich. When artificial or manufactured

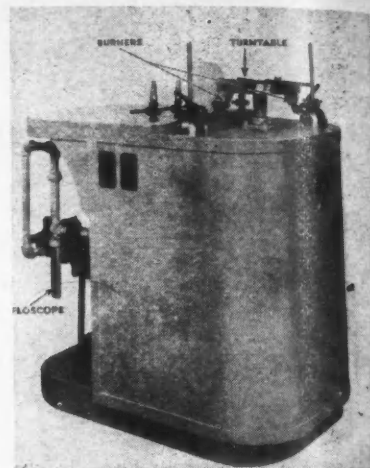


Bellevue "Gas Producer"

gas is used, means must be provided for the removal of sulphur and its compounds. The air-gas ratio used to produce the desired atmosphere is set by means of the micrometer adjusting valve of the precision gas mixing controller. This definite gas-air mixture is then passed through a fire check valve and into the special burner and burned within the primary and secondary combustion chambers. The water vapor—a product of combustion—is condensed out of the prepared pro-

B-21—Two-Point Toggle Press

This is a new two-point, double action toggle press, streamline design with all gears and drive unit located in the box type crown, built by the Cleveland Punch & Shear Works Co., Cleveland 14, Ohio. The press has two slides, an inner slide and an outer, or blankholder slide. The inner slide has a stroke of 28 in., 6 in. adjustment, 500 tons capacity, while the outer slide has a stroke of 26 in., 6 in. adjustment and 300 tons capacity. The press operates at the rate of six strokes per minute.



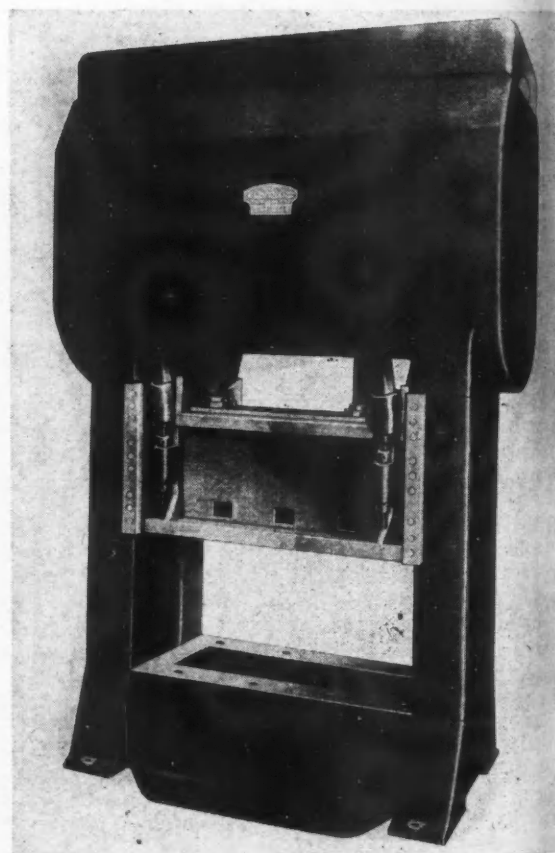
Selas heat-treating table

ductive atmosphere by water cooled condensers and collected by means of water traps.

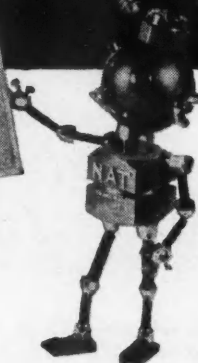
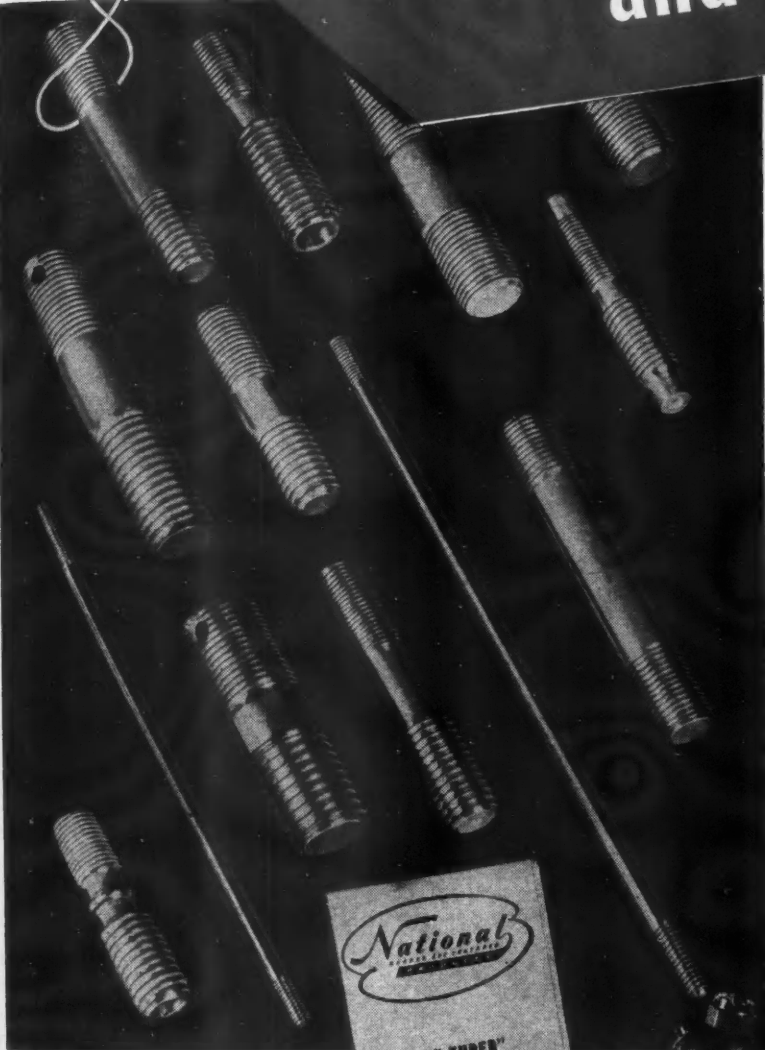
The Bellevue "Gas Producer" may be built in sizes to generate 350, 650, 2000, 3500, 9000 and up to 60,000 cu ft per hour.

B-22—Variable Speed Heat Treating Table

Annealing, hardening, silver-brazing, soft soldering and other heating operations can be handled on a new heat-treating table designed and manufactured by the Selas Corp. of America, Philadelphia 34, Pa. A revolving vari-



LOK-THRED STUDS are TIGHTER and STRONGER



IN ANY APPLICATION where studs are used, "LOK-THRED" Studs will lock more securely and prove stronger in both tension and torsion than American National Threads.

The "LOK-THRED" design avoids the chief weakness of ordinary interference fit, which places the metal of the receiving thread under shear and thus tends to cause a bursting or splitting action.

Note these other important advantages of "LOK-THRED" which are explained fully in the new booklet pictured here:

1. Modified American National Thread permits use of standard tools. (Page 6.)
2. Does not require selective fits. (Page 6.)
3. Locks securely and becomes tighter in service. (Page 9.)
4. Carries entire normal working load on 6° angle at root of thread under high compressive prestress. (Page 11.)
5. Does not gall when being driven nor fret in service. (Page 12.)
6. Stronger in both tension and torsion than ordinary American National Threads. (Page 12.)
7. Has much higher fatigue limits than studs with conventional threads. (Page 13.)
8. Acts as dowels and taper pins. (Page 16.)
9. Seals positively and eliminates added bosses and blind tapping. (Page 17.)
10. Re-usable and on any re-application less than one-half additional turn brings torque back to its original installation value. (Page 17.)

*Write for "LOK-THRED"
Booklet for full information.*

THE NATIONAL SCREW & MFG. COMPANY, CLEVELAND 4, OHIO



Fork truck adapted for use with drop-bottom skid dump box by Automatic Transportation Co.

able-speed jig-table accommodates work pieces of many sizes and shapes. Two Superheat burners, having a turn down ratio of 40 to 1, are accurately adjustable to any position. Additional burners or different types of burners can be supplied as required.

To maintain fuel at the particular proportions and pressure required by each job, air and gas pass through Floscopes (visual flowmeters) to a Selas combustion controller. An automatic fire check guards the mixture line.

The heat-treating table is shipped completely assembled. It is ready to operate as soon as gas and electrical connections are made.

B-23—Drop Bottom Skid Dump Box

Designed to make mechanized methods possible in handling metal shavings, scrap, small forgings and castings and similar loose or bulk materials, this 4000-lb telescopic Automatic fork truck has been adapted by its manufacturer, Automatic Transportation Co., 149 W. 87 St., Chicago 20, Ill., for use with this drop-bottom skid dump box.

Its simplicity of operation is said to make the unit applicable for almost any operation involving heavy loads of loose material. The box can be placed beneath drilling machines, lathes or other equipment where loose materials are produced or accumulated. When it is filled, it is picked up like an ordinary skid platform by the fork truck. The load is raised and the steel loops at the upper rear corners of the box hook over the pegs at the top of the truck's uprights. When the forks are lowered, the hinged bottom of the dump

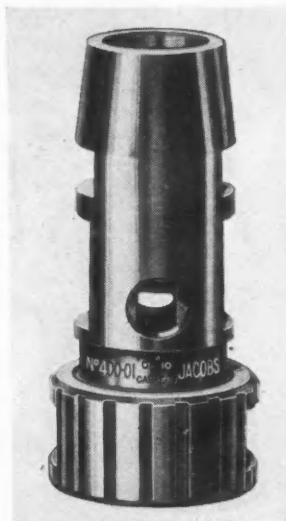
box automatically opens, dumping the contents into rail cars, trucks or other receptacles.

Any standard Automatic fork truck may be adapted for use with this box, making it suitable for the multitude of operations involving loose materials.

B-24—Lightweight Tap Chuck

A new small diameter tap chuck featuring lightness in weight, is now ready for distribution by the Jacobs Manufacturing Co., 100 Jacobs Rd., Hartford, Conn. Designed particularly for tapping heads and tapping machines, this chuck provides another application of the Jacobs Rubber-Flex collet. The extreme lightness and small diameter of the chuck are said to combine to develop less torsional inertia, reduce tap breakage particularly in bottom tapping and allow for quicker reversing and higher spindle speeds.

The Rubber-Flex collet is made up of several hardened steel jaws permanently bonded into a synthetic rubber body which is resistant to deterioration caused by heat, coolants or cutting compounds. All working surfaces of the collet are precision ground after molding and the collet is centralized by a ground conical bore in the chuck body.



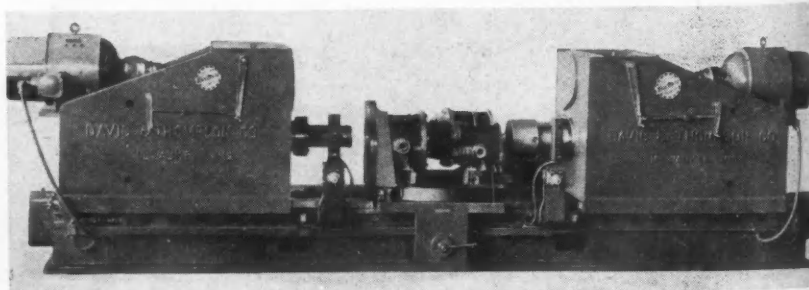
Jacobs tap chuck

B-25—Grinder for Carbide Tools

The Bradford Machine Tool Co., 657 Evans St., Cincinnati 4, Ohio, is now manufacturing a Model 260 Carbide tool grinder. Mounted on left is a regular grinder for rough work, and right side is for mounting of cup wheel for accurate finish grinding. Work table is precision machined and is adjustable

(Turn to page 76, please)

B-26—Special Boring Machine



In developing this 2 W1 boring machine, the Davis & Thompson Co. of Milwaukee has made possible the boring of large holes to accurate dimensions and at a high rate of production. The machine illustrated bores a 14 3/4 in. diameter hole 12 in. deep from one side and a 9 in. diameter hole 12 in. deep from the opposite side. Rate of production is two parts or 8 bores per hour. The machine is equipped with an indexing table on which the fixture is mounted. When boring is done from opposite sides and work is complete, all bores are in alignment.

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achieve*

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IN Udylite AUTOMATIC PLATING MACHINE

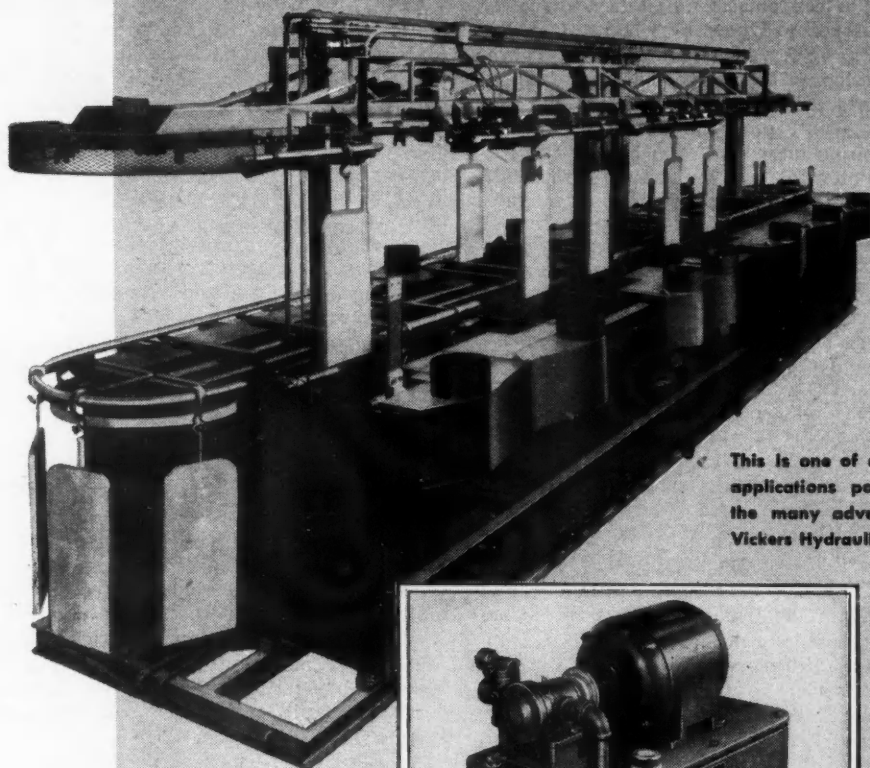
This Udylite machine does a complete plating job automatically . . . taking each part through seven tanks and a drying chamber . . . timing exactly the interval in the various solutions for cleaning, plating and rinsing.

Each part (or rack of parts) is automatically lowered into each of the seven tanks in turn—then lifted out and transferred to the next tank. This might be done with a multiple dip conveyor. But the conveyor slants permissible in lowering and raising in that way require extra tank length.

Udylite made the machine far more compact—saving 18" to 24" in the length of each tank—by using Vickers Hydraulic Equipment to raise and lower the entire conveyor assembly at each transfer. By this means, each piece (or rack) is lifted straight out of the tank, moved over the next tank and lowered straight down. This provides better cleaning and more uniform plating—better drainage and less contamination of the solutions.

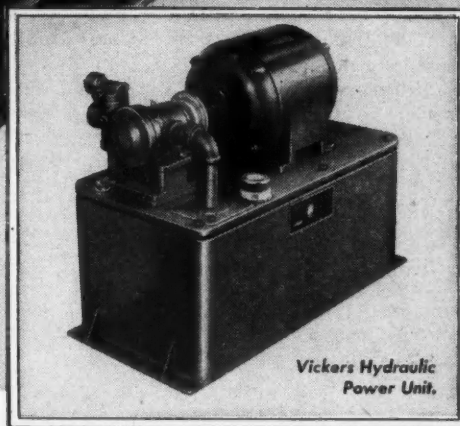
The Vickers Hydraulic Power Unit and Control Valves have many advantages for such applications: (1) proven dependability, (2) accurate control and precise timing, (3) flexibility of control to suit varied production requirements, etc.

The versatile features of Vickers Hydraulic Equipment on this



Above: Elevated position for transfer from one tank to the next.

This is one of a series of applications pointing out the many advantages of Vickers Hydraulic Controls.



Vickers Hydraulic Power Unit.

type of application, as on many other industrial installations, have made possible increased production, improved product quality, greater safety, and lessened physical demands upon labor while increasing its productivity. Vickers Application Engineers will gladly discuss your individual control problems.

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New BULLETIN

Write for Bulletin 46-43
describing Vickers Hy-
draulic Power Units.

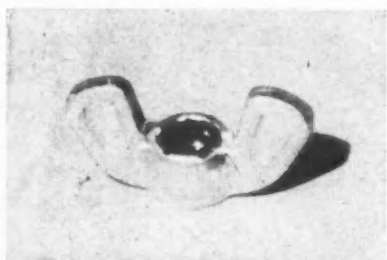


NEW Products

C-18—Wing Nut with Nylon Collar

A new self-locking wing nut, featuring a red elastic nylon locking collar, has been produced by Elastic Stop Nut Corp. of America, Union, N. J. It was developed to answer design requirements calling for the convenience of a wing nut, plus the ability to lock in position anywhere on a bolt or stud.

Potential applications of the self-locking wing nut exist on automobiles



ESNA wing nut

and trucks, industrial equipment and special machinery of all kinds, or on any assembly where adjustability and removability are required.

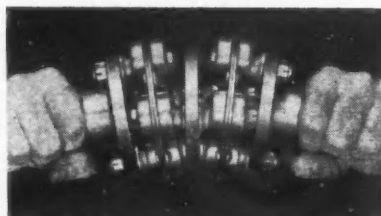
Wing nuts are made available in four diameters with both fine and coarse threads. Machine screw sizes, in fine threads, are 8/36, 10/32 and 12/28, with the fractional size of 1/4-28. Coarse thread sizes are 8/32, 10/24 and 12/24, in addition to 1/4-20.

ESNA wing nuts are made of die-cast zinc, with all nuts in regular production supplied in plain finish. Nickel plating can be furnished on special order.

C-19—Constant-Velocity Double Coupling

Double Morflex couplings—a universal-joint type—are now in full production, according to Morse Chain Co., Detroit 8, Mich., and Ithaca, N. Y.

Since the Double Morflex is, in effect, two single Morflex couplings with a center plate adapter, the new model has twice the torsional resilience of the single coupling. Torsional resilience is obtained through the preloaded Neoprene biscuit construction. Acting as a universal drive connection, the double coupling accommodates offset and angular misalignment of shafts.



Double Morflex couplings

The double Morflex permits constant velocity between driving and driven member. With no metal-to-metal contact, Morflex requires no lubrication, is proof against noise and vibration and is di-electric.

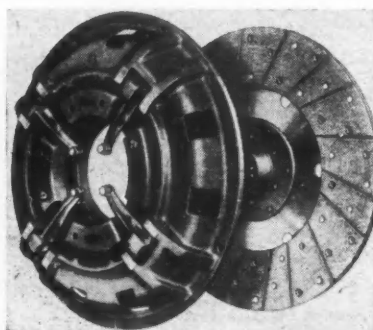
The double coupling is available in 10 sizes, in capacities of 13 to 725 lb ft of torque.

C-20—Heavy-Duty Non-Adjustable Clutch

The Lipe "TC" clutch line made by the Lipe-Rollway Corp., Syracuse, N. Y., is said to offer a non-adjustable clutch that does not lose torque capacity with the dissipation of frictional material. These units are of spring-loaded, dry plate, toggle lever type, featuring built-in provision for reducing torsional vibration.

This line was designed to provide ample capacity for engines developing from 340 to 1500 lb ft torque, ranging in sizes of 14 in.; 15 1/2 in. and 17 in. single plate and 15 1/2 in. and 17 in. two plate.

The design allows quick disassembly or assembly without special tools or equipment. These clutches, because of unique toggle lever construction, require no internal adjustments to main-



Lipe Type TC clutch

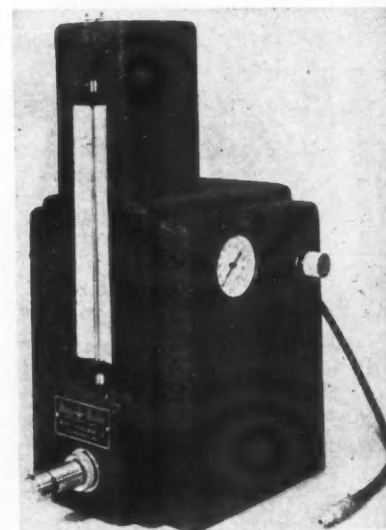
tain torque capacity or to counteract facing wear, as they are fully self compensating. They are built with controlled parallelism between pressure plate face and friction face of flywheel.

Clutch function is smooth during the kinetic period of engagement because every square inch of facing area is engaged at the same time and pressure plate movement is controlled to provide smooth engagement with a positive transmittal of torque. They are provided with air circulatory vanes and heat radiation grids, providing built-in features for high thermal convection, thus insuring maximum cooling.

All parts are dynamically balanced on special equipment designed by Lipe for this purpose. To counteract the need for a "dampener" type member the units are provided with a built-in vibration dampening feature in the cover plate assembly which inherently tends to counteract the effect of torsional vibration.

C-21—Pneumatic and Taper Gages

Merz Engineering Co., Indianapolis, Ind., has developed a complete line of pneumatic and taper gages, known as "New-Matic," with "reversed-flow" air control featured in all models. The "reversed-flow" principle is found exclusively in Merz New-Matic gages. This feature provides both a calibrated



Master model New-Matic gaging machine

measurement scale of the required magnification and a "zero" adjustment for returning the calibration to a basic value. To obtain this accurate inspection device, Merz New-Matic gages are equipped with continuously variable and adjustable orifices, making possible the control of air volume, as well as air pressure, and providing "balanced air" for high-precision measurement.

These new gages are not merely comparators but are actual measuring machines, as well. Variations from

The CONE AUTOMATIC MACHINE COMPANY



sees many

GOOD THINGS AHEAD

It is reported that

"Styrofoam," styron plastic expanded 40 times into a multicellular, foamlike mass, is being offered by Dow Chemical Co., as an insulating material.

get ready with CONE for tomorrow

Soft enough to be machined, punched or drawn, two new magnet metals, Cunico and Cunife, have been developed by General Electric Co.

be ready with CONE for today

Large and complex glass-to-metal seals are made at Westinghouse Lamp Division by spraying liquid-suspended powdered glass on hot Kovar metal.

get ready with CONE for tomorrow

Especially intended to prevent shifting of loads in freight cars and trucks, Load-Lok, a glue made by National Adhesives, has high sheer strength, but can be broken at will in unloading.

be ready with CONE for today

The new Lycoming XR-7755, a 36-cylinder radial, develops 5,000 h.p. at 2,600 r.p.m., and is said to be the world's most powerful aircraft engine.

get ready with CONE for tomorrow

The U. S. Department of Agriculture is now operating an experimental alcohol plant at Peoria with a capacity of 500 gallons per day from farm waste.

be ready with CONE for today

U. S. Rubber Co. is selling a lighter-than-cork cellular rubber that is resistant to moisture, fire, rot, acid, oil, vermin and termites.

get ready with CONE for tomorrow

Union Pacific R. R. has placed orders for 64 diesel-electric locomotives. This is said to be the largest order for diesel-electric locomotives in railroad history.

Atlantic Coast Fisheries Co. has developed a machine with which one operator can fillet had-dock at the rate of 45 per minute.

get ready with CONE for tomorrow

Barber-Colman Co. has a new machine to automatically perform threading-up operations on textile looms by the use of punched cards.

be ready with CONE for today

The Pennsylvania Coal Co. will supply its miners with music by means of loud speakers at the top and bottom of the mine shaft.

get ready with CONE for tomorrow

A simple change in tread design makes the new Firestone Tractor Tire out-pull previous tires.

The Spang-Chalfant Div. of National Supply Co. in Pittsburgh is making steel pipe with a baked-on phenolic plastic coating which has been tested for several years in the oil fields.

be ready with CONE for today

Hobart Bros. Co. has designed a self-propelled and self-powered mobile arc welder for use in railway yards, oil refineries and large factories.

get ready with CONE for tomorrow

The thumbnail size silicon crystals made by Sylvania Electric Products can be used as first detectors in superheterodyne receivers, and unlike tubes, require little space and no filament supply.

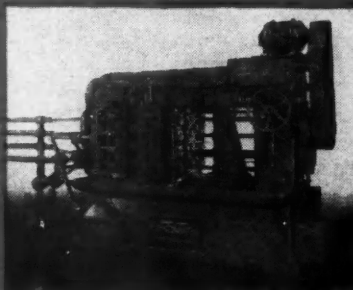
be ready with CONE for today

The Locomotive Development Committee of Bituminous Coal Research expects to conduct on-the-rail tests of its coal-fired gas turbine locomotive this summer.

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AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U.S.A.

39

New Products

standard dimensions are shown on scales or dials in graduations to meet customers' requirements. They are made in five models to fit inspection requirements of every type—in the gage laboratory, on high-speed production operation, for checking finished dimensions at the machines. The Merz "Master" New-Matic offers a standard calibrated scale for any required magnification up to 20,000/1. The Merz "Versatile" New-Matic provides a normal scale covering .004 in. and magnification of approximately 1,000/1.

Merz taper gages consist of two Merz New-Matic gages, equipped with a special fixture incorporating large and small taper-gaging rings of hard steel. Taper variations are registered on one gage to plus or minus 30 min in graduations of 5 min—or, if preferred, to plus or minus 10 min in graduation of 1 min. Out-of-round condition is shown simultaneously on the second dial in graduations of .0001 in., to a total of .002 in.

C-22—Heavy Load Hardness Tester

The Wilson Mechanical Instrument Co., Inc., 230 Park Ave., New York 17, N. Y., is introducing a new heavy load Model LR "Tukon" hardness testing machine. Designed for light and heavy load testing, it applies loads of from 25 to 50,000 grams. This Long Range model contains all the features of the



Model LR Tukon tester

C-23—Light Weight Industrial Wheels



A line of light weight industrial wheels, ranging in size from 6 in. to 12 in. and in load rating from 480 to 1200 lb has just been offered by Thermoid Co., Trenton, N. J. The wheel is made of a light-weight aluminum alloy casting with oversized ball bearings and built-in grease seals. There is a large grease reservoir, equipped with a standard grease gun fitting. The rubber tread is smooth, cut resistant and quiet in operation

Knoop and 136 deg Diamond Pyramid Indenter (Vickers type). It incorporates a fast speed elevating screw for adjustment to specimen thickness; a meter giving operator assurance the load is being applied to the Indenter and indicating when the electronic tube is in operating condition and when the test cycle has been completed. The Knoop Indenter is used for tests from 25 grams to 3600 or 5000 grams. The 136 deg Diamond Pyramid Indenter is used for tests from 25 to 50,000 grams. Loads of 10,000 grams are furnished as standard equipment. Loads from 10 kg to 50 kg are accessories.

C-24—Electrode for Welding Cast Iron

Airco No. 375 electrode for machinable welds on cast iron has been introduced by the Air Reduction Sales Co., 60 E. 42 St., New York 17, N. Y.

This is an electrode with a high nickel core wire and a heavy extruded coating that has a possible application wherever an electrode is used on cast iron. This electrode should be of special use in the automotive field for production line repair work and for use on all castings requiring machinable welds. Ordinarily preheating is not necessary.

Because of its high nickel content,

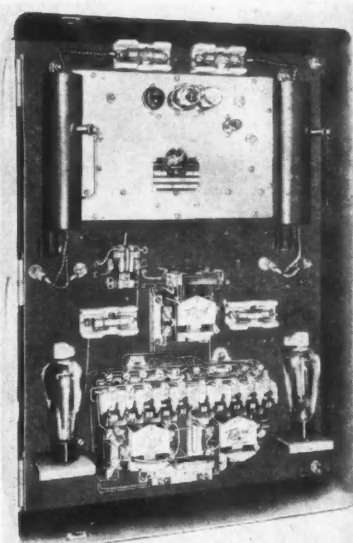
Airco No. 375 flows exceedingly well and the resultant deposit is sound. The weld and fusion zone is said to be soft and easy to machine. Also, it will withstand hydrostatic pressure and may be used in the downhand, vertical or overhead positions. Multiple pass welds can be made without danger of cracking.

This new electrode may be used on either alternating or direct current and is available in 5/32-in. and 3/16-in. diameters. The manufacturer plans to add 3/32-in. and 3/16-in. diameters if the demand for them is large enough to warrant their addition.

C-25—New Electronic Motor Control

Two models of a new electronic motor control for operating d-c motors from a-c power have been announced by Federal Electric Products Co., 50 Paris St., Newark, N. J.

One model is a general purpose, reversing type applied to a 2 hp, 230 volt d-c motor, and the second is a special



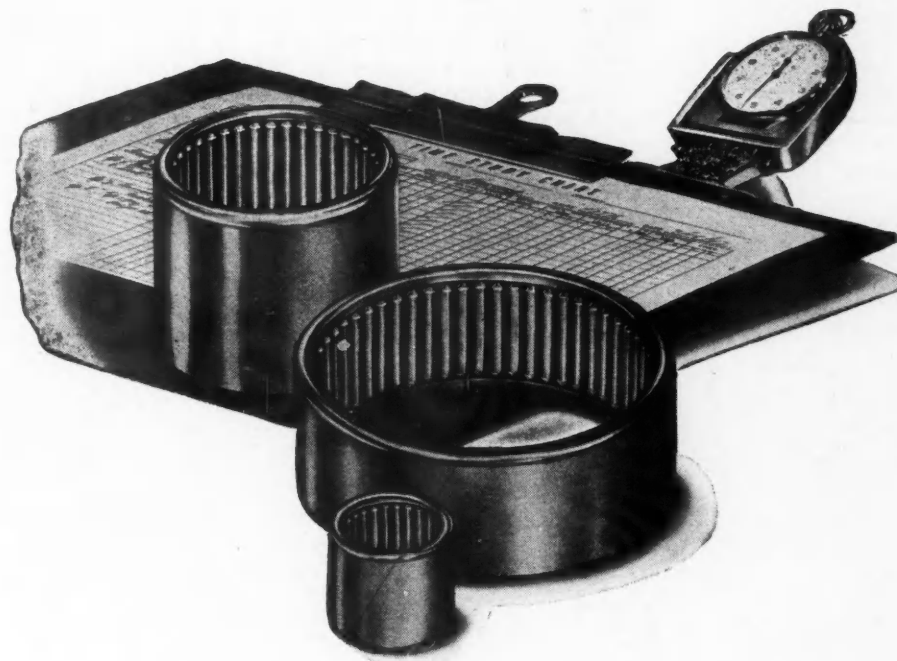
Federal motor control

control for an Abrasive M-3 surface grinder.

The Federal electronic control is said to closely regulate motor speed to provide an almost flat speed torque curve with changes in load having little effect on speed. For any speed setting, performance is practically equal to that of a synchronous motor even with a suddenly applied load.

Precise automatic current limiting makes it possible to preset the maximum allowable armature current and is an important control feature. The electronic circuits limit the current to the preset value regardless of load. Even with the armature locked mechanically and the speed setting at maximum, this value of current is not exceeded.

With automatic current limiting,



When every second counts...

Whether you are laying out a design, tooling up for production or meeting an assembly schedule, Torrington Needle Bearings can help you speed up every operation. You can

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first because their sturdy, compact construction helps simplify many design problems. Then, too, they help reduce fabricating time—a plain bore, machined to proper dimensions, provides the bearing housing. And assembly is speeded because no spacers or retainers are required—and installation involves only a simple arbor press operation. Thus, you can save production time and reduce costs with Torrington Needle Bearings. Our Catalog #32 contains complete data including many helpful production suggestions.

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New Products

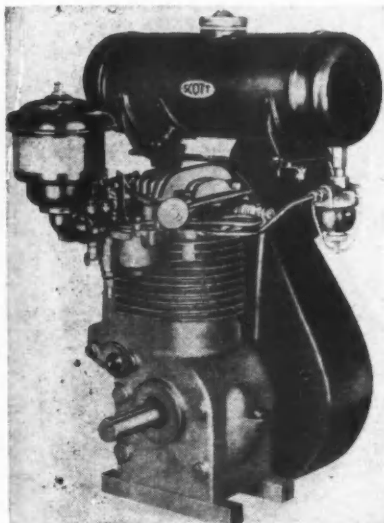
smooth, stepless acceleration from standstill is possible without drawing excessive current from the line. This feature protects motor and control in case of overload, and protects load since current limiting action is also a torque limiting action.

Factory production of the control will get underway during the last six months of 1947, Federal announced.

C-26—Small, Lightweight Four-Stroke Engine

A new light weight two-hp, four-stroke engine to be produced by the Scott Engine Co., 1 N. La Salle St., Chicago 1, Ill., will feature an easily-replaceable head embodying the valve mechanism and combustion chamber.

An integrally cast crankcase housing and cylinder block of aluminum is the



Scott engine

principal weight saving feature. The 2¼-in. aluminum piston has a 2¼-in. stroke.

Features contributing to ease of maintenance are replaceable valve guides, a replaceable cast iron cylinder liner, and a simplified arrangement for valve adjustment. To expose the valve mechanism, only two readily-accessible nuts need be removed. All accessory parts such as the carburetor, filters, etc., are standard.

C-27—Six New Products Offered by Caterpillar

Two new Diesel engines, two Diesel track-type tractors and two Diesel motor graders powered by these engines are offered by Caterpillar Tractor Co., Peoria, Ill. Increased power, improved design, and new materials are

incorporated in these post-war replacements for six models in the Company's line of products.

Included in the array of new machines are the four-cylinder D315 and the six-cylinder D318 engines, new D4 and D6 tractors and new Diesel No. 12 and Diesel No. 112 motor graders.

The D315 engine replaces the D4400 engine and the D318 replaces the D4600 engine in the "Caterpillar" line, providing one-third greater power output than the previous models. The power increases in the two engines are reflected in greater work capacity in the tractors and motor graders which they power.

The D315 engine has a maximum output, with radiator fan and full equipment, of 70 hp, while the D318 is similarly rated at 105 hp. Both engines are available as industrial units, electric sets and marine engines.

The new D6 tractor develops 65 drawbar hp and 75 belt hp, an increase of 10 hp over comparable figures for the previous model; while the new D4 tractor, with 43 drawbar hp and 48 belt hp, offers a 20 per cent increase in work power over the model it replaces.

Increases are carried into the new motor graders, the new Diesel No. 12 offering 100 hp and the new Diesel No. 112 developing 70 hp. This capacity places the Diesel No. 12 in a new class so far as the grader field is concerned while the Diesel No. 112 now qualifies to handle much of the work hitherto reserved for the largest size motor grader.

C-28—Stainless Steel Electrodes

A complete line of stainless steel electrodes in a full range of grades and diameters has been brought out by Wilson Welders & Metals Co., Inc., 60 E. 42 St., New York 17, N. Y.

C-29—New Grinding Wheel



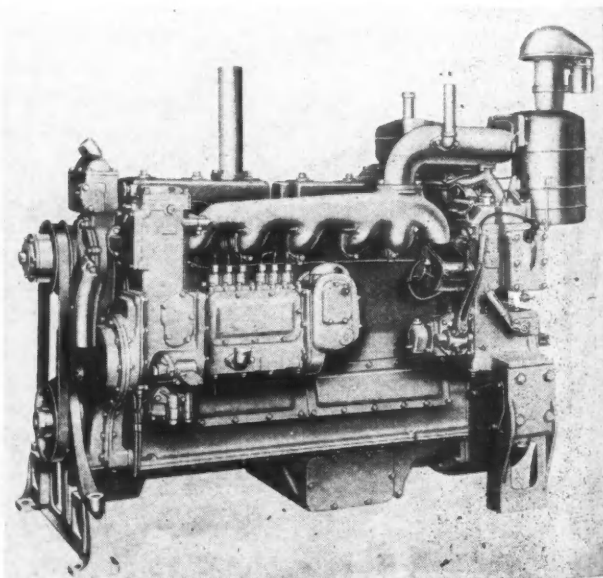
Series 20 grinding wheels are the latest addition to the line of the Carborundum Co., Buffalo Ave., Niagara Falls, N. Y. They are said to be a completely new type of ceramic or vitrified bonded grinding wheel with a new blend of abrasive grains. The illustration shows a Series 20 wheel grinding a lamination punch die. This operation, an interrupted cut, was performed at a table traverse of 35 fpm taking a cut .010 in. deep.

All Wilson stainless steel electrodes are furnished with a heavy extruded lime type coating for d-c application. In addition, all but the straight chrome analyses are obtainable with a lime-titanium type coating which is usable on alternating or direct current. The slag produced by either of these coatings is easily removed.

Electrodes with the lime-titanium, a-c—d-c type coating, are said to offer many desirable features not found in the lime type coated electrodes. For example, satisfactory usability on alternating current eliminates arc blow and results in easier manipulation, more uniform arc action, and better appearance.

(Turn to page 67, please)

Caterpillar D318, 105-hp Diesel engine.



POWER



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May 1, 1947

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The Ford Chronology

(Continued from page 46)

April 18—Ground broken for Willow Run plant.
 April 28—Benson Ford elected a director of the company.
 April 29—29 millionth Ford car presented Red Cross Motor Corps.
 June 1—Classes opened in Aircraft Apprentice School.
 July—New four-cylinder truck engine introduced.
 July 25—First Aircraft Engine tuned in Test Cell.
 Aug. 12—First machinery installed at Willow Run.
 Aug. 15—First Ford-built Pratt & Whitney engine moved off assembly line 11 months after Aircraft Engine building started.
 Sept. 12—1942 models previewed.
 Sept.—First Armor Plate casting.
 Sept. 25—Mass production of tanks planned.
 Oct. 15—First bomber part produced at Rouge.
 Dec. 4—Tank parts manufactured at Rouge plant.
 Dec. 12—Company starts seven-day week.
 Dec. 31—Work started on armor plate foundry and hot mill extension.
 1942, Feb. 10—Civilian car production stopped by government order.
 Ford receives the Mark Twain medal.
 March 14—First B-24 landing gear built.
 April 16—First tank engine built.
 1942, May 8—Ground broken for aluminum foundry.
 June 4—First M-4 tank built.
 June 15—Educational B-24 completed and left assembly line at Willow Run.
 June 25—First cargo truck built.
 July 3—First supercharger completed.
 July 12—First knocked-down B-24 bomber shipped.
 July 15—First steel poured in new steel foundry.
 July 28—First M-7 anti-aircraft director built.
 July—George Washington Carver Laboratory dedicated.
 Sept. 2—First amphibian jeep built.
 Sept. 10—First built-up B-24 production ship completed at Willow Run.
 Sept. 16—First 15-place glider built.
 Sept. 18—First armor plate rolled on the hot strip mill.
 Sept. 20—First 3 in. M-10 gun mount built.
 Oct. 10—First M-10 tank destroyer built.
 Oct. 17—First M-5 anti-aircraft gun director built.
 1942, Nov. 28—Production bombers No. 1 and 2 flown from Willow Run.
 Dec. 19—First rate-of-climb instrument built.
 1943, March 23—First light armored car built at Twin City branch.
 March 25—First universal carrier built at Somerville branch.

May 26—Edsel B. Ford dies.
 June 1—Henry Ford re-elected president.
 June 14—First M-20 utility command car built.
 July 2—First Navy bomb service truck built.
 Dec. 15—Henry Ford II elected vice-president of company.
 1944, Jan. 6—Test flight of CG-13 glider at Dearborn Airport.
 Jan. 23—Henry Ford II elected executive vice-president.
 1944, Feb. 24—10,000th student graduated from AAF school at Willow Run Army Air Base.
 April 24—42 ships flown away from Willow Run in one day.
 July 26—Twin City and Chicago branches complete 5000 light armored cars.
 Aug. 8—20,000th student graduates from Naval Training School.
 Nov. 5—First flight of prototype ship (single tail) at Willow Run.
 Nov. 1—Robot bomb engine research begun.
 Dec. 4—Light car plans announced for postwar production.
 Dec. 7—7000th Liberator built at Willow Run.
 Dec. 11—Employee retirement plan announced.
 1945, Jan. 1—Civilian truck production resumed.
 April 28—Five-day week resumed.
 June 28—Last bomber off Willow Run production line.
 July 3—Ford passenger car production resumed.
 Nov. 1—Lincoln and Mercury passenger car production resumed.
 Sept. 21—Henry Ford II named president of company.
 1947, April 7—Henry Ford died at Dearborn, Mich.

GE Building New Plant For Silicone Production

A new plant being built at Waterford, N. Y. by the General Electric Co., will provide complete facilities for the development and large scale production of silicones for a variety of automotive applications.

The latest product of silicones is a paint for trucks and motor cars. Tests of this finish indicate the possibility that it may be ready for production use within five years. Experimental results show that the silicone formulation is highly resistant to severe weather conditions, chemicals, and heat. Not only is the finish said to retain its original color and gloss indefinitely, but GE expects to produce brighter and clearer colors. At the present time silicones are being produced only on a pilot plant scale.

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE and AVIATION INDUSTRIES

Moderate reductions in general business activity are indicated. The *New York Times* index for the week ended April 5 stands at 142.2, as against 147.2 for the preceding week and 127.3 a year ago.

Sales of department stores during the week ended April 12, as reported by the Federal Reserve Board, equaled 266 per cent of the 1935-39 average, as compared with 319 per cent in the week before. Sales were 6 per cent below the corresponding distribution a year earlier, as against a preceding excess of 17 per cent. The total in 1947 so far reported is 12 per cent greater than the comparable sum in 1946.

Electric power production decreased slightly in the week ended April 12. The output was 15.1 per cent above the corresponding amount in 1946, as compared with a like advance of 17.7 per cent shown for the preceding week.

Railway freight loadings during the same period totaled 758,166 cars, 6 per cent more than the figure for the week before and 16.8 per cent above the corresponding number recorded last year.

Crude oil production in the week ended April 12 averaged 4,912,950 bbl daily, 21,350 bbl more than the preceding average and 221,550 bbl above the comparable output in 1946.

Production of bituminous coal and lignite during the week ended April 5 is estimated at 3,800,000 net tons, 69 per cent below the output in the week before. The total production in 1947 so far reported is 2.3 per cent above the corresponding quantity in 1946.

Civil engineering construction volume reported for the week ended April 17, according to *Engineering News-Record*, is \$110,091,000, or 12 per cent less than the preceding weekly figure and 29 per cent below the comparable sum in 1946. The total recorded for 16 weeks of this year is 12 per cent more than the corresponding amount in 1946. The increase in private construction is 5 per cent, and the rise in public construction is 26 per cent.

The wholesale price index of the Bureau of Labor Statistics for the week ended April 12 is 148.1 per cent of the 1926 average, as compared with 148.8 for the preceding week and 109.3 a year earlier.

Member bank reserve balances increased \$53 million during the week ended April 16. Underlying changes thus reflected include a decline of \$140 million in Treasury deposits with Federal Reserve banks, accompanied by a decrease of \$87 million in money in circulation.

Total loans and investments of reporting member banks increased \$85 million during the week ended April 9. An advance of \$9 million in commercial, industrial and agricultural loans was recorded. The sum of these business loans, \$11,180 million, shows a net increase of \$3,620 million in 12 months.



Basic principles of lubrication govern the performance of sleeve bearings. Proper application of those principles and the innate quality of Bunting Bronze Bearings give assurance of successful operation in service. The wide experience of our engineers is at your disposal. **THE BUNTING BRASS & BRONZE COMPANY, Toledo 9, Ohio.** Branches in Principal Cities.

BRONZE BEARINGS

PRECISION BRONZE BARS

BUSHINGS

64

Bunting

PERSONALS

Recent Personnel Changes and Appointments at the Plants of Automotive and Aviation Manufacturers and Their Suppliers.

Chrysler Corp.—Joseph Pfeiffer, Director of Purchases.

Nash-Kelvinator Corp., Nash Motors Div.—R. James Molloy, Asst. Parts Manager; Dayton L. McClellan, Asst. Service Manager.

Ford Motor Co.—Helen Koues, Color and Fabric Consultant for Styling Dept.

Titeflex, Inc.—Henry S. Elder, named Vice-President.

United States Steel Corp., Carnegie-Illinois Steel Corp. Div.—Charles G. Purnell, Development Representative in the market development division.

Young Radiator Co.—James A. Stahn, Engineering Representative.

Danly Machine Specialties, Inc.—Paul R. Fields, Purchasing Agent.

Indian Motorcycle Co.—R. C. McDonald, Production Manager.

Farrel-Birmingham Co., Inc.—D. K. McLean, Export Manager for all lines of Machinery.

Raybestos-Manhattan, Inc.—John H. Matthews elected Vice-President in charge of the Manhattan Rubber Div.; O. H. Cilley, Asst. General Manager of the United States Asbestos Div., made a Vice-President; A. F. Heinsohn, General Manager of General Asbestos and Rubber Div., is a member of the new Board of Directors.

Borg-Warner International Corp.—Robert Black, Product Manager, Engine Components.

The Perfect Circle Corp.—Irving Lacy, made Personnel Asst. to the President; Kent Morse, on the staff of Manufacturing Div.; George Myers, Asst. Plant Manager at Hagerstown, Indiana.

Eaton Manufacturing Co.—R. H. Daisley, Vice-President and Director of Manufacturing; H. J. McGinn, Vice-President and Director of Sales. Richard Inglis was elected Vice-President and General Counsel.

Thermoid Co.—T. E. Allen, Asst. to the President on sales, will direct sales of Automotive Replacement Div. during absence of F. D. Beecher.

Pratt & Whitney Div., Niles-Bement-Pond Co.—Richard F. V. Stanton, elected Vice-President, continuing his present position of Asst. Machine Tool Sales Manager.

United States Rubber Co., Gillette Tire Div.—E. S. Little, Merchandise Manager of tires and tubes.

General Motors Institute—S. E. Skinner, Vice-Pres. of General Motors Corp. and General Manager of the Oldsmobile Div., was elected to the board of regents. H. J. Klinger, Vice-Pres. of General Motors Corp. and General Manager of Pontiac Motor Div., was

elected a Vice-President of the Institute.

Wheelco Instruments Co.—Elmer Schneider, Vice-President and Director of Engineering.

Monarch Machine Tool Co.—Wendell E. Whipp, elected Chairman of the Board; Jerome A. Raterman, President. Mr. Whipp succeeds F. P. Thedieck, recently deceased.

Standard Mirror Co.—Joseph J. LaHodny, elected President and Director.

The Electric Products Co.—Robert H. Ehret, Asst. Sales Manager.

Publications Available

(Continued from page 47)

A-115—Check Valves, Cone Check Valves

The Parker Appliance Co.—4-page folder giving general description, pressure drop charts and engineering data on Parker swing check valves, identified as Bulletin No. A42. Bulletin A53 contains similar information on Parker cone check valves.

A-116—Bonderite Catalog

Parker Rust Proof Co.—A new catalog on Bonderizing, the treatment for metals which preserves fine finishes by anchoring the paint and retarding corrosion. The 44-page illustrated catalog includes pictures of test panels showing accelerated and weathering tests on various treated and untreated metals. It contains much new information on the Bonderizing process and its application on steel, aluminum, zinc and their alloys, on die castings; and on Bonderite as an aid in deep drawing of steel and aluminum.

A-117—Hydraulic Testing Machine

Baldwin Locomotive Works—Bulletin No. 182 describes in detail the Sonntagg Model S-10 Universal Hydraulic Testing Machine and gives complete specifications. Model S-10 is a very compact machine of 20,000 pounds capacity designed especially for mass production testing.

A-118—Drilling Machines

Sibley Machine & Foundry Co.—An attractive 2-color folder has been issued describing and illustrating the Sibley 24 and 28 inch drilling machines and accessories. The booklet gives details of such design features as Rotary Geared Coolant Pump, Geared Tapping

Attachment, Feed Mechanism, Motor Drive and Top Frame Assembly.

A-119—Speed Selector

The B. F. Goodrich Co.—A broad side on the new improved Variable-V. Planetary infinite ratio Speed Selector recently announced jointly by Speed Selector, Inc., and The B. F. Goodrich Co. has been published. It describes the construction of the Speed Selector and contains pages outlining the engineering principles of operation, with illustrations, dimensions, horsepower and torque ratings of the three models available.

A-120—Gear Science In Sound Film

The Fellows Gear Shaper Co.—The art of generating and gear manufacturing equipment is the subject of a 16 mm 2-reel (55 minute) sound motion picture in natural colors, covering the theory, design, tooth action and contact of gears, and their production and inspection. An 8-page booklet giving highlights from the sound film is available by writing to The Fellows Gear Shaper Co., Springfield, Vermont.

Record MEMA Membership

The new roster of the Motor & Equipment Manufacturers Association lists an all-time high in members, credit service subscribers and associate members. As of now there are 528 manufacturers affiliated with the MEMA of which 91 have been accepted as members, credit service subscribers or both since October 1, 1946. Automotive Affiliated Representatives, manufacturers' representatives who are MEMA associate members, have an all-time membership high of 217.

Wouldn't power like this do a real job on YOUR job?



MR. T. C. JAMES
Lubbock, Texas

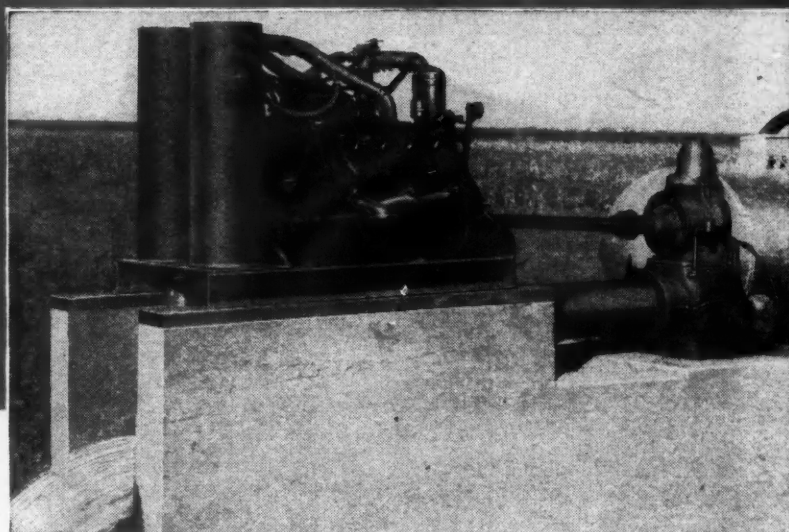
This Ford V-8 engine has been in continuous service since 1941. It irrigates 125 acres planted to cotton and grain. Average fuel cost is 27 cents per hour, using butane gas.

"10,669 pumping hours—equivalent to 400,000 miles at 40 miles an hour—with only one ring job!"

That's what Mr. T. C. James, Lubbock, Texas farmer, writes from his cost records on this Ford engine.

"Repeatedly, 5 and 6 months at a stretch, day and night, without major maintenance."

And Mr. James adds: "The average yield on dry land farming in this area was one bale of cotton to eight acres. I picked 145 bales off 107 acres!"



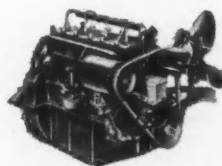
A Ford-built engine, properly installed, is an asset in any piece of equipment—from everybody's point of view. It simplifies *manufacturing*; the source of supply is stable and service parts are available the world over. It helps *sell* the equipment, because the whole world knows and respects Ford engines. It is an enduring asset to the man who *buys* and *uses* the equipment, because Ford reliability, simplicity, economy and universal service facilities mean lasting satisfaction. So, whether you build, sell or use engine-powered equipment in the Ford power range, get your copy of the Ford Industrial Engine Catalog.

FORD MOTOR COMPANY

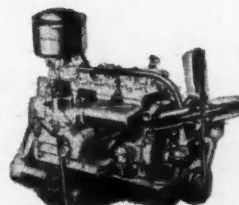
Industrial and Marine Sales Department
3510 SCHAEFER ROAD • DEARBORN, MICHIGAN

Ford engines are used to power—

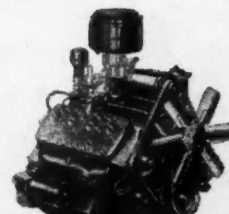
Agricultural Machinery • Orchard Equipment • Air Compressors • Road and Construction Machinery • Derricks and Hoists • Electric Generating Plants • Arc Welders • Fire-Fighting Equipment • Industrial Tractors • Lumber and Saw Mill Equipment • Oil Field Equipment • Pumps • Railway Motor Cars—and many other applications.



THE 40-H.P. FOUR
119.5 cubic inches
displacement



THE 90-H.P. SIX
226 cubic inches
displacement



THE 100-H.P. V-8
239 cubic inches
displacement

FORD-BUILT ENGINES

PREFERRED FOR INDUSTRIAL AND MARINE POWER

May 1, 1947

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63

Electronic New Plant Communications System

Modern competitor of the time honored teletype and telautograph systems, which are used widely in scheduling production in motor car plants, was demonstrated to a representative of this publication recently. The system consists of an electronic transmitter into which is fed a tape containing the information for scheduling, used in combination with a multiplicity of receiving sets capable of reproducing faithful copies of the original tape. Certain advantages are claimed for the method in competition with the de-

vices now in use. Among other things, the manufacturer intends to sell the equipment outright rather than on a rental basis.

This electronic system has been perfected in prototype but is not yet in production. Although the name of the producer is held confidential we shall be glad to transmit inquiries.

Avco Buys Engine Plant

The Avco Manufacturing Corp., Lycoming Div. of Williamsport, Pa., has bought a surplus internal combustion engine plant for \$560,000 from the War Assets Administration. The plant was formerly operated by the Aviation Corp.

Specify STROM BALLS



Hand Gauging
of large diam-
eter Strom Balls
before packaging

When you specify Strom Balls you are sure of getting balls with the highest obtainable degree of finish, sphericity, precision—balls that give the very highest quality of service in any bearing equipment. This high degree of perfection is the result of Strom's concentration for a quarter of a century on metal balls exclusively and the perfection of the processes and workmanship necessary to produce them. Strom Steel Ball Company, 1850 South 54th Avenue, Cicero 50, Illinois.

Strom BALLS Serve Industry

Largest Independent and Exclusive Metal Ball Manufacturer

CALENDAR

Conventions and Meetings

- Chamber of Commerce of the United States, Annual Mtg., Washington, D. C.Apr. 28-May 1
- Amer. Foundrymen's Association, Annual Convention, Detroit, Apr. 28-May 1
- Soc. of Automotive Engineers, Personal Airplane Mtg., Wichita, Kansas, May 1-2
- The Society of the Plastic Industry, Nat'l. Plastics Exhibition, Chicago, May 6-10
- Soc. for Experimental Stress Analysis Annual Mtg., ChicagoMay 15-17
- Nat'l. Assoc. of Motor Bus Operators Annual Mtg., ChicagoMay 21-22
- Amer. Soc. of Mechanical Engineers—Oil & Gas Power Nat'l. Conference—ClevelandMay 21-24
- Auto. Engine Rebuilders Assoc. Convention, DetroitMay 22-24
- Mid-America Exposition, Cleveland—May 22-31
- Amer. Soc. of Mechanical Engineers—Aviation Mtg., Los Angeles, May 26-29
- Inst. of the Aeronautical Sciences Personal Aircraft Mtg., Detroit, May 26-27
- Metal Powder Assoc., Spring Mtg., New YorkMay 27
- Soc. of Automotive Engineers—Summer Mtg. French Lick Springs, Ind. June 1-6
- The National Federation of Sales Executives, Los AngelesJune 2-4
- Amer. Soc. of Mechanical Engineers—Semi-Annual Mtg., Chicago, June 16-19
- Amer. Soc. of Testing Materials—Annual Mtg., Atlantic CityJune 16-20
- Amer. Soc. of Mechanical Engineers—Applied Mechanics Div., SchenectadyJune 23-25
- American Electroplating Society, DetroitJune 23-27
- Institute of the Aeronautical Sciences, Annual Summer Mtg., Los Angeles, Aug. 7-8
- Soc. of Automotive Engineers—West Coast Transportation & Maintenance Mtg., Los AngelesAug. 21-23
- Amer. Soc. of Mechanical Engineers—Fall Mtg., Salt Lake CitySept. 1-4
- Amer. Soc. of Mechanical Engineers—Ind. Instruments & Regulators Div., ChicagoSept. 8-9
- Instrument Society of America Conference, ChicagoSept. 8-12
- Society of Automotive Engineers—Tractor Mtg., Milwaukee....Sept. 17-18
- Natl. Machine Tool Builders Assoc. Machine Tool Show, Chicago, Sept. 17-26
- Soc. Automotive Engineers, Aeronautic Mtg., Los AngelesOct. 2-4
- Amer. Soc. of Mechanical Engineers, Petroleum Mech. Eng. Conf., Houston, Tex.Oct. 6-8
- Natl. Conference of Industrial Hydraulics, ChicagoOct. 16-17
- Soc. of Automotive Engineers, Production, ClevelandOct. 20-21
- Natl. Aircraft Show, ChicagoNov. 1-9
- Amer. Soc. of Mechanical Engineers, Annual Mtg., Atlantic City....Dec. 1-5
- Automotive Service Industries Show, ChicagoDec. 8-12

Borg-Warner Handles R. N. Nason Exports

The export activities of R. N. Nason & Co., manufacturer of automotive synthetic enamels and lacquer, will be handled by Borg-Warner International Corp.

THIS IS THE *Beginning*

THE FIRST STEP in the manufacture of castings is one of the most important. Various types of raw materials are brought together and measured in accordance with certain specifications preparatory to melting in the cupolas. In the Campbell, Wyant and Cannon foundries, charging operations are most carefully controlled by the metallurgical laboratories, and the weighing of the materials (as shown in painting) is done with greatest accuracy. This is only one of the many specialized C.W.C. foundry procedures that are significant in the production of sound, quality castings.



Campbell, Wyant and Cannon Foundries

MUSKEGON, MICHIGAN Henry Street Plant, Sanford Street Plant, Broadway Plant

SOUTH HAVEN, MICHIGAN National Motor Castings Division

LANSING, MICHIGAN Centrifugal Fusing Company



CAMPBELL, WYANT AND CANNON FOUNDRY COMPANY
MUSKEGON, MICHIGAN

If you manufacture...

**You can save 3 WAYS with...
Essex "Packaged" Wiring Harness**

1. ENGINEERING

2. FIRST COST

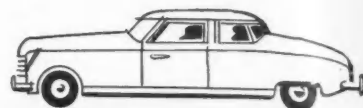
3. INSTALLATION

Scores of manufacturers have found that they save *time, trouble and money* by turning their electrical wiring harness problems over to Essex specialists.

Essex *One-Source* service handles the intricate job of producing lighting, ignition and control harness assemblies *custom-built* to your exact specifications and *complete* with all manual and electrical control devices for quick, efficient installation.

Through intensive specialization in wiring harness assemblies, Essex has developed line production methods of manufacturing, assembly and inspection, for the economical production of high grade, individually tested, specially engineered assemblies.

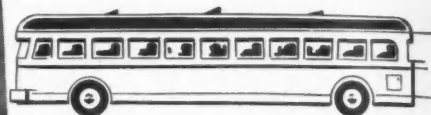
Investigate Essex "One-Source" service today!



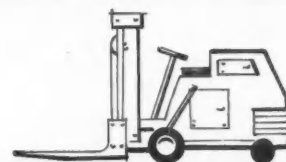
Automobiles



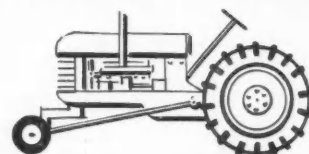
Trucks and Trailers



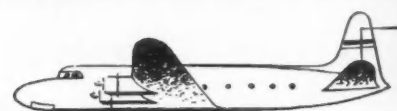
Busses and Trackless Trolleys



Industrial Electric Trucks



Tractors



Aircraft

ESSEX WIRE CORPORATION FORT WAYNE 6, INDIANA

Plants: Fort Wayne, Indiana; Detroit, Michigan; Anaheim, California
Warehouses* and Sales Offices: *Atlanta, Georgia; *Boston, Mass.; *Chicago, Ill.; Cleveland, Ohio; Dallas, Texas; Dayton, Ohio; *Detroit, Mich.; Kansas City, Mo.; *Los Angeles, Calif.; Milwaukee, Wisc.; *Newark, N. J.; Philadelphia, Pa.; St. Louis, Mo.; *San Francisco, Calif.



New Products

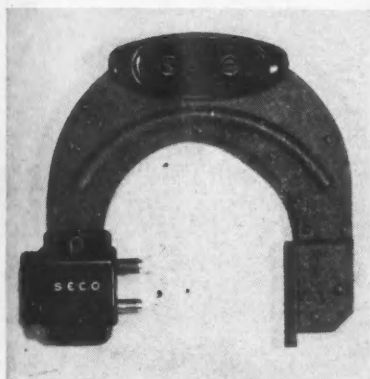
(Continued from page 58)

ance of deposit. This class of electrodes is recommended by the maker for all applications on which the lime type of electrode is used, with the possible exception of highly restrained joints on heavy sections or on steels of high hardenability.

C30—New Adjustable Snap Gage

An adjustable snap gage of novel design, intended for hand gaging of parts up to 4.75 in. wide or in diameter, is a new product of Dietrich W. Botstiber & Associates, 300 W. Upsal St., Philadelphia 19, Pa. The gage is extra light in weight, yet suitable for use under heavy duty conditions, such as gaging pieces still on the machine, to check limits between operations.

The gage is enclosed in a housing of molded plastic which protects it from abuse and from non-uniform temperature changes, the large sizes have only the adjusting system enclosed and carry a separate handle on the frame. A transparent window on the housing



Botstiber snap gage

permits insertion of a name plate marked with adjustment data or job number. The housing may be sealed to prevent unauthorized change of adjustment.

Accuracy of adjustment is said to be as close as 0.00004 in., which is accomplished by utilizing the elastic elongation of the gage bolts for fine adjustment. This makes the accuracy of adjustment independent of the pitch of the bolt threads. To reduce wear, the gaging points are hard chrome plated.

C31—New Carboly Boring Tools

A comprehensive line of seven basic styles of standardized carbide tipped boring tools, in from four to six sizes each, is now available from Carboly Co., Inc., Detroit, Mich. Five of these styles represent additions to the pre-

vious standard stock line of round shank square end tools. The five new styles comprise two types of round shank tools for 30 deg and 45 deg boring bars, in four sizes each, and three types of square shank tools for use in 30 deg, 45 deg and 90 deg boring bars in six sizes each. All styles are carried in stock in grades for both steel cutting and boring of cast iron and other materials.

C-32—Protective Coating

A new type of black, cold-applied protective coating, known as Bituplastic, is soon to be made generally available by the Wailes Dove-Hermiston Corp. of Westfield, N. J.

Bituplastic is a dispersion in water of highly-refined plastic coal tar pitch and other materials. Because of its unusual composition it can be applied to damp surfaces whether metal, concrete or masonry.

Applied by brush or spray, Bituplastic dries quickly—in from 15 minutes to two hours under average humidity and temperature conditions.



MANEUVERABILITY Plus Power—Plus Portability Plus TUTHILL Leaf Springs in LORAIN Moto-Crane

THIS 20-ton LORAIN Moto-Crane, built by The THEW Shovel Co., Lorain, O., is fitted with TUTHILL Springs. Installed on Lorain Moto-Cranes, these heavy-duty alloy steel springs are set far apart to give a wide, stable base to prevent side-roll.

Crane carrier chassis is designed for the revolving, live and highly concentrated loads of shovel and crane operation. Shocks and impacts are absorbed by TUTHILL Springs, sturdy and strong, standing firmly under all load conditions.

Tuthill makes a complete line of leaf springs, standard or special. What are your requirements?



**TUTHILL
SPRING CO.**
760 W. Polk St.,
CHICAGO 7, ILL.

Quality Leaf Springs for Sixty-Seven Years

FAST...SMOOTH WORKER

BURROS are more than fast, smooth working locomotive cranes. They're speedy, powerful switch engines too! Heavy draw-bar pull of the BURRO makes it easy to spot cars for loading or unloading where and when you want them. Fast travel speed (up to 22 m.p.h.) enables these cranes to get to the job and start work quickly. There is no waiting time with a BURRO on the job.

BURROS are equally efficient with bucket, magnet, hook, tongs or drag-line, and they handle anything in their capacity with speed and economy. Simple, easy one-man control of the BURRO cuts time and costs on any job you have. BURROS are made in two models—both powered by rugged gasoline engines. Investigate these versatile BURROS today.

Write for illustrated bulletins.



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If you have a SPECIAL PROBLEM

in any of these operations, where precision work is demanded and where greater production at man-hour savings is paramount—

- BORING—rough, semi-finish and finish • MILLING (special types) • STRAIGHT LINE DRILLING • UNIVERSAL ADJUSTABLE SPINDLE DRILLING • HONING • TAPPING • REAMING • COUNTERBORING • VERTICAL AND WAY-TYPE EQUIPMENT ...

then a Moline Multiple Spindle Specially Designed machine tool is your answer. Moline tools are ruggedly built and engineered to fit your PARTICULAR requirements, they're made to last for years, they're easy to change over to other jobs, they do better work at less cost and stand up to it longer.

For YOUR special problem, go "HOLE-HOG," write us for any information you may need.



MOLINE TOOL COMPANY

100 20th Street

Moline, Illinois

Ford Control Feminine

(Continued from page 23)

approximately 55 per cent of the voting stock in the company and his wife 3½ per cent. Edsel Ford held approximately 41½ per cent of the voting stock at the time of his death and his holdings were left to his widow, Mrs. Eleanor Clay Ford, and to the four children in equal shares. Latest figures show 172,645 shares of voting stock and 3,250,255 shares of non-voting stock outstanding. The board of directors is authorized to issue 20 million shares.

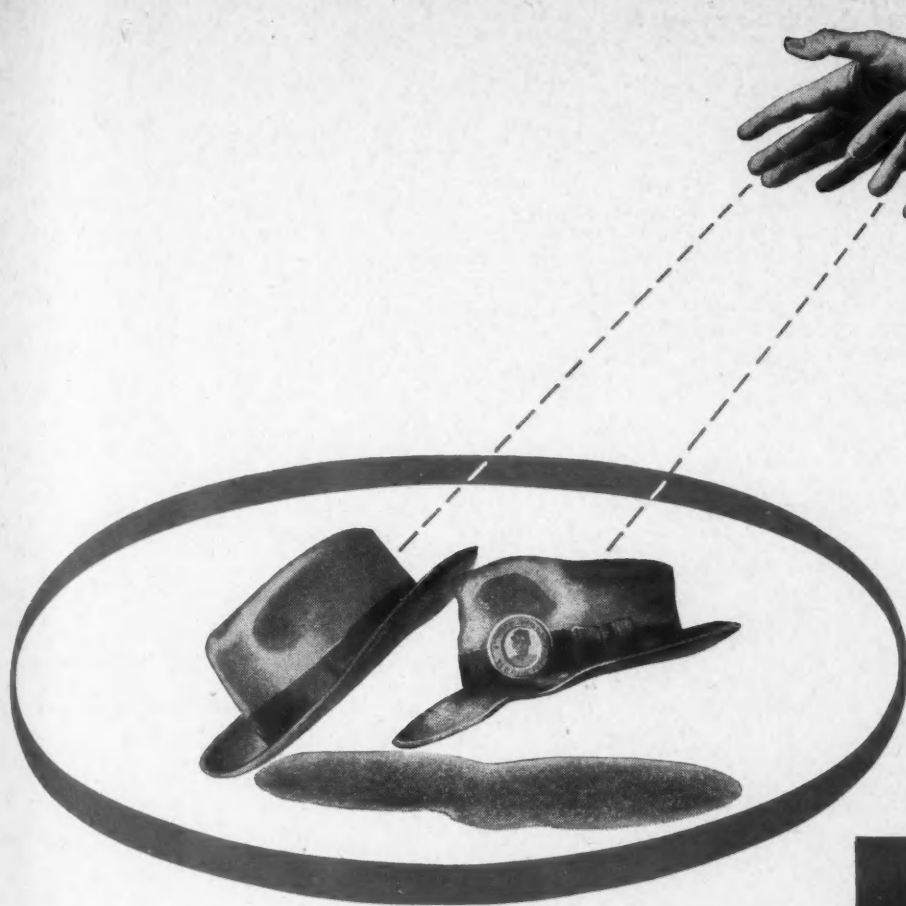
Because of uncertainty as to what Mrs. Edsel Ford will take, if anything, of the 1/5 of the voting stock bequeathed to Edsel Ford in Henry Ford's will, actual percentages that each member of the family will control are not yet available. Under Michigan law, Mrs. Edsel Ford might take ⅓ or 1/5 of her deceased husband's share. There is reason to believe, however, that she will relinquish any claim to the 1/5 bequeathed to her husband. Stock distribution in each of the three above mentioned eventualities are shown in the table (on page 70).

Actual voting control of the company rests in the hands of Mrs. Edsel Ford, until at least July 7, 1948. Under the terms of the wills of both Edsel Ford and Henry Ford, the share to each of Edsel Ford's children is left in trust until the recipient reaches the age of 25. Two of the children, Mrs. Josephine Buhl Ford and William Clay Ford, are still under that age and Mrs. Edsel Ford is trustee of their shares. Consequently, she will have voting control until July 7, 1948, at which time Mrs. Josephine Buhl Ford will receive her share of both her father's and grandfather's estate. William Clay Ford will be 25 early in 1950. It is interesting to note that until that date, three women together—Mrs. Edsel Ford, Mrs. Henry Ford, and Mrs. Josephine Buhl Ford—will hold voting control of the mighty Ford empire which until a few years ago would allow no women employees.

All of Mr. Ford's non-voting stock in the company was bequeathed to the Ford Foundation, a non-profit organization, devoted exclusively to receiving and dispersing funds for "scientific, educational, and charitable purposes, all for the public welfare." At the time of his death, Edsel Ford also turned his non-voting stock over to the Ford Foundation.

Attorneys for the estate could give no estimate of the amount of Mr. Ford's personal fortune, but it has been estimated at close to \$500 million. He left his home, Fairlane, at Dearborn, together with the Richmond Hill Farm in Georgia and

(Turn to page 70, please)



TWO HATS IN THE SAME RING

ENLIGHTENED labor leadership and enlightened management have come to share a vital area of common agreement: That wages come from earnings . . . that earnings come from greater sales . . . that increased sales come from

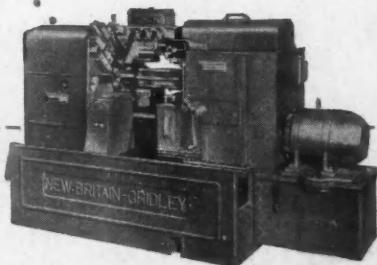
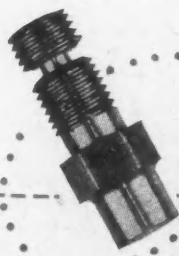
lowered costs . . . that lowered costs come from more efficient production.

Therefore, the new, more efficient machines, better tools, improved methods are the great symbols of our common hope for the future. To management,

the duty of providing the means. To hourly rated employees, the duty of making the fullest use of them.

EXAMPLE: A further operation to remove the protruding metal at the center of the head of the piece illustrated would slow down production and increase costs. As the job is produced on a Model 60 New Britain Screw Machine, a rotating pick-off spindle prevents the piece from twisting

off before the cut-off tool has finished its travel, leaving the surface smooth to the manufacturer's requirements as the unretouched photo shows. The resulting production rate of 431 finished pieces per hour is a good example of lowering costs without lowering any standards, for the benefit of all.



New Britain Automatics

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN-GRIDLEY MACHINE DIVISION
NEW BRITAIN, CONNECTICUT

M-01056

May 1, 1947

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69

numerous farms and properties in Wayne County to his wife. All other real estate was given to the Ford Foundation. Mrs. Henry Ford is named as executrix in a codicil to the will after Edsel Ford's death.

Value of the stock has not been established. However, a determination of value now is in process in the Federal Tax Court on the matter of determining inheritance taxes on the Edsel Ford estate. Mrs. Eleanor Clay Ford, executrix of the \$200 million Edsel Ford estate has estimated that the Ford stock is worth \$58 a share. That figure is

based on the value set by the Federal Tax Court in the Couzens case and brought up to date. The Federal Government, however, for tax purposes, has estimated value of the stock at \$190 a share. Determination in this case will considerably shorten the tax computation period for the Henry Ford estate. It is believed that the combined State and Federal inheritance tax will amount to approximately 77 per cent but that there will be sufficient cash resources in the estate to pay the taxes without having to sell any of the Ford Foundation stock.



Wyman-Gordon has originated and developed many forging designs in steel, aluminum and magnesium and has pioneered in the development of proper grain flow . . . Typical of such a development: an aluminum alloy piston forging.

Standard of the Industry for Sixty Years

WYMAN-GORDON

Forgings of Aluminum, Magnesium, Steel

WORCESTER, MASSACHUSETTS, U. S. A.

HARVEY, ILLINOIS

DETROIT, MICHIGAN

Distribution of Voting Stock in Ford Motor Co. If Mrs. Edsel Ford Takes:

One-third of Edsel Ford's One-Fifth

	Per Cent	
Mrs. Edsel Ford	11.96	84.54 per cent
Mrs. Henry Ford	3.5	
Henry Ford II	21.135	
Benson Ford	21.135	
Mrs. Josephine Buhl Ford	21.135	
William Clay Ford	21.135	

One-Fifth of Edsel Ford's One-Fifth

	Per Cent	
Mrs. Edsel Ford	10.5	86.0 per cent
Mrs. Henry Ford	3.5	
Henry Ford II	21.5	
Benson Ford	21.5	
Mrs. Josephine Buhl Ford	21.5	
William Clay Ford	21.5	

No Share of Edsel Ford's One-Fifth

	Per Cent	
Mrs. Edsel Ford	8.3	88.2 per cent
Mrs. Henry Ford	3.5	
Henry Ford II	22.05	
Benson Ford	22.05	
Mrs. Josephine Buhl Ford	22.05	
William Clay Ford	22.05	

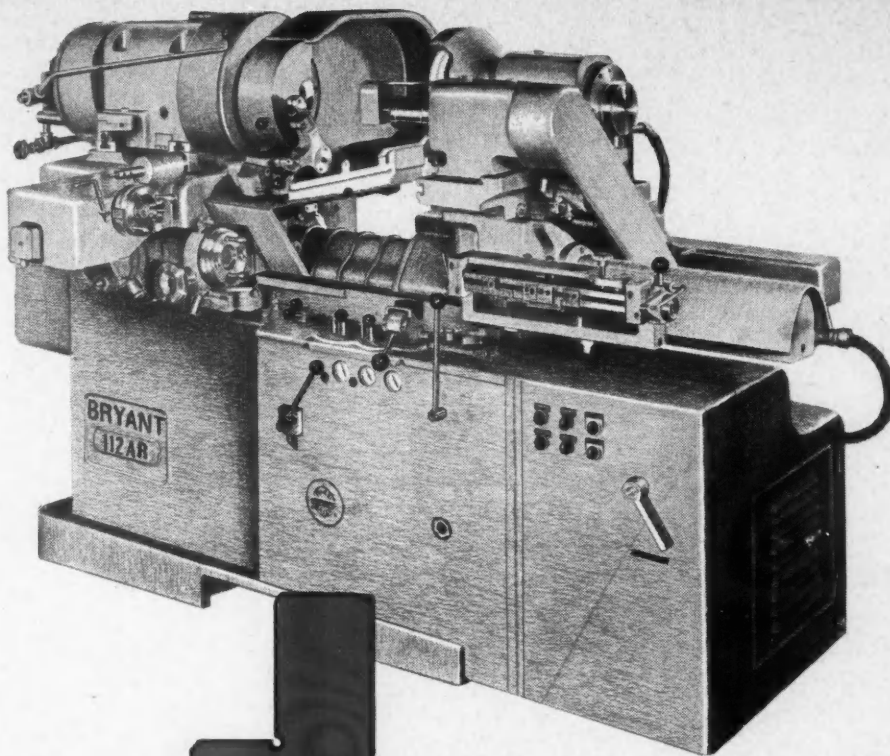
Copper Tariff Suspension Helps Car Industry

Automotive manufacturers are encouraged by the possibility of final Congressional action suspending the four-cent-per-pound import tariff on copper. The House and Senate have approved the action and now are ironing out minor differences. Suspension of the tariff would be for a two year period in order to build up the nation's depleted copper stock pile.

Key to British Flight Center

(See illustration on page 22)

1. Central Admin. and Departmental H.Q. Offices
2. Compressed Air Tunnel, 16 ft x 12 ft
3. Atmospheric Tunnel, 16 ft x 12 ft
4. High Speed Tunnel, 16 ft x 12 ft
5. Atmospheric Tunnel, 16 ft x 12 ft
6. High Speed Tunnel, 16 ft x 12 ft
7. Spinning Tunnel
8. U. S. Airflow Laboratory
9. U. S. Tunnel, 8 ft x 8 ft
10. Large High Speed Altitude Tunnel
11. Exhausting and Compressing Plant
12. Refrigeration and Cold Chamber Buildings
13. Supersonic Tunnel, 3 ft x 3 ft
14. General Purpose Aero Laboratory
15. Two 13 ft by 9 ft Atmospheric Tunnels
16. Compressed Air Tunnel, 16 ft x 12 ft
17. Atmospheric Tunnel, 16 ft x 12 ft
18. Naval Aircraft Laboratory and Offices
19. Naval Aircraft Wind Tunnel
20. No. 1 Structures Laboratory
21. No. 2 Structures Laboratory (Research)
22. Metallurgy Div., Main Building
23. Metallurgy Div., Laboratory Forge
24. Metallurgy Div. Laboratory Foundry
25. Chemistry Div. Laboratories and Offices
26. Central Electrical Sub-station
27. Central Heating Plant and Power Station
28. Medical and Welfare H.Q.'s
29. Workshop Organization Offices
30. Main Workshops and Stores
31. Departmental Flight H.Q. and Laboratories
32. Flight Hangars
33. Paved Flight Apron
34. Taxi Track to Thurleigh Airfield
35. Taxi Track to Twinwood Airfield
36. Main Access road from Bedford



For Grinding

INSIDE

and OUTSIDE Diameters in a Single Chucking

The new No. 112-AR Bryant fills the need for a fast, precise machine for grinding internal and external diameters in a single chucking of the work — for reducing production time on parts where concentricity is an important factor. The 112-AR has two wheelheads carried on a common longitudinal slide. The workhead indexes from one spindle position to the other on a transverse slide, and is controlled by separate feedscrews at each of these positions. This machine will grind two separate diameters, one of which may be an outside diameter, as well as the face of the work. For facing operations, a turret stop and axial feedscrew are provided.

A similar machine, the new No. 112-AH, is designed for grinding one inside diameter and a face to extremely close squareness limits. This machine has a feedscrew for internal diameter control and an axial feedscrew for facing operations.

These two hydraulically operated grinders have a maximum swing of 16" and grinding stroke of 9"; workhead is adjustable to grind an included angle of 90°.

THE NEW NO. 112-AR

**ANOTHER BRYANT
POSTWAR DEVELOPMENT**

Send for the Man from

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

BRYANT



May 1, 1947

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71

Only WARNER ELECTRIC BRAKES

Give you *all* these
Time-and-Money-Saving Advantages

Engineered to meet the Specific Needs of Trailer Braking

SIMPLICITY — No other brakes equal Warner Electric Brakes for simplicity of design and construction. Full clearance under tractor and trailer. Nothing to get knocked off, leak, chatter or freeze. No exposed braking equipment . . . no rods to rattle . . . no tubes to split . . . no troublesome boosters and connections. Easy to install . . . no tapping of manifolds . . . no expensive motor work.

INSTANTANEOUS, POSITIVE ACTION — Positive-acting braking power is developed within the brake itself. Because the braking mechanism is *electrically controlled*, there is no time lag. Regardless of distances from cab to rear trailer wheels, any amount of stopping power is *instantly available*.

CONTROLLED BRAKING POWER — Driver can pre-set the "Vari-Load" dial on dash so it adjusts the electric brakes on the trailer to give correct braking to meet road and load conditions.

SYNCHRONIZED OPERATION WITH EITHER AIR OR HYDRAULIC SYSTEMS — Warner Controller synchronizes hydraulic or air brakes on tractor with Electric Brakes on trailer. Regular tractor foot pedal then operates both systems *together*.

ALL-PURPOSE CONNECTION — One rugged Electrical Cable Connection provides contacts for Brakes, Running and Parking Lights, Stop and Turn Signals—ALL electrical contacts. As easy to plug in as a radio.

UNMATCHED ECONOMY — Warner Electric Brakes are inexpensive to install due to their simplicity. Use only as much current as tail light. The most important economy factor is that they require minimum of servicing thus preventing costly delays and tie-ups of trailer equipment.

PROVED DEPENDABILITY — Warner Electric Brakes have been performance-proved by leading tractor-trailer fleet operators during many years of efficient, trouble-free service — also on thousands of military vehicles. It is noteworthy that 80% of all power-brake equipped trailing vehicles purchased by the government during World War II — had Warner equipment.

GREATER SAFETY — When both the tractor and trailer are equipped with Warner Electric Brakes their *instant* "stopping power" under *absolute control* assures greater safety. All brakes "come in" at the same time, but with various *amounts* of power. Therefore, rear trailer wheels get the effect of coming in first — and the tendency to skid or jack-knife is prevented, thus giving protection to driver and load — and avoiding costly repairs and tie-ups of equipment.

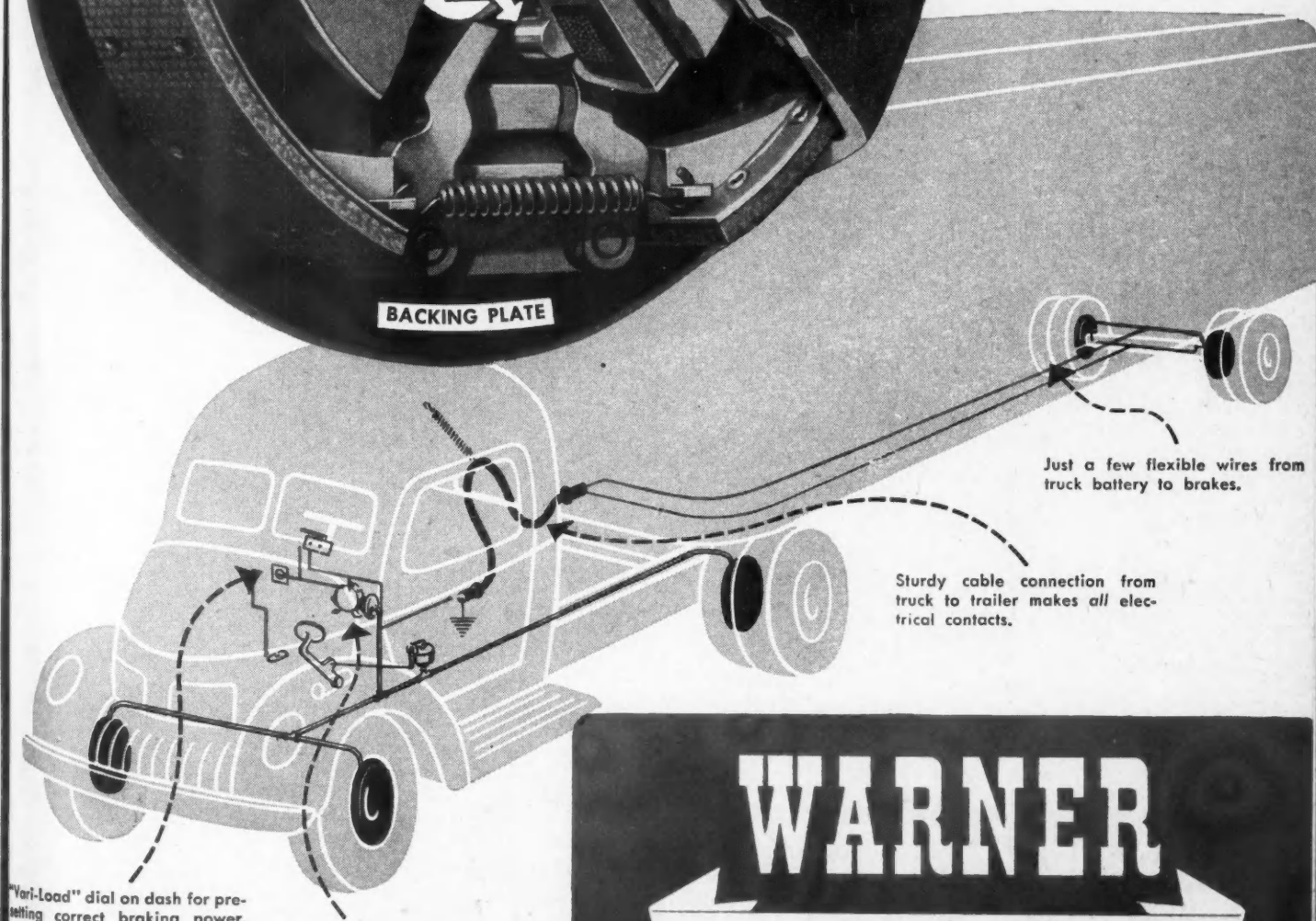
For best performance and customer satisfaction, standardize on Warner Electric Brakes for your trailers. Write for illustrated literature explaining all their advantages.

WARNER ELECTRIC BRAKE MFG. COMPANY
BELOIT, WISCONSIN

Specialists in the manufacture of Electric Trailer Brakes since 1927



The Warner Electric Brake is a simple mechanical brake, operated by an electro-magnet and armature disc. Each wheel is a complete brake unit. The braking power is generated within the brake itself. A wire to the battery and a controller complete the system — famous for its simplicity.



"Vari-Load" dial on dash for pre-setting correct braking power.

Controller operates trailer's electric brakes in unison with truck's hydraulic or air brakes.

WARNER

ELECTRIC BRAKES

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1927

Packard Convertible

(Continued from page 35)

in combination is offered as optional equipment; and the rear axle ratio is 3.9 to 1.

Special attention has been given to body and frame design to produce a rigid mounting free from noise and vibration. To this end, the frame for convertibles has heavy plates welded to the upper and lower flanges of the X-members. In addition, the frame carries two additional body brackets on each side.

The heating and ventilating system

consists of two major elements. For heating, there is an underseat heater with defroster attachment. Fresh air is drawn in through two ducts, one on each side, from the front end. The ducts, of large diameter, are a part of the sheet metal system, thus making for rigidity and freedom from noise. They terminate in grilles on each side of the front compartment. Intake of fresh air is manually controlled by the driver and is said to provide sufficient fresh air to assure freedom from fogging of glass under any operating conditions.

Details of the Dura Hydro-Lectric system for power operation of the

front and quarter windows, the top, and seat adjustment will be given in an early issue of AUTOMOTIVE AND AVIATION INDUSTRIES.

Hardness Tester

(Continued from page 37)

specimen, which may be mounted in plastic, is ground and finished with polishing paper, care being exercised so the grinding effect does not extend below the surface. Then it is polished on wet lead laps; alternately polished to a mirror finish with a soft abrasive, and lightly etched with acid to bring out the grain boundaries. This dual process is continued until no disturbed metal is observed under the microscope. The operator of the microhardness tester then places the specimen under the microscope on a movable bed plate and selects the grain or area to be tested. When this is determined the sample is transferred to the penetrator mechanism. The penetrator arm, balanced with its adjustable weight suspended on knife edges, slowly bears down its weight to make the indentation. After the indentation has been made, the sample is moved back under the microscope and examined. Depending on the hardness of the sample, indentations may range upwards of two microns in depth, which is proportional to the diagonal of the square indentation, which also is measured in microns.

Tests Engine Mounts

(Continued from page 42)

Fig. 3 shows the damping effect of various materials. These data were obtained by imposing various frequencies on a system having a single degree of movement, the amplitude of movement of the suspended weight being recorded at each frequency. Such studies showed that an infinite and uncontrolled amplitude of the weight occurs in mechanism without internal friction such as a steel spring. On the other hand when internal friction is introduced as in the case of rubber, a definite and measurable amplitude results.

This machine is claimed to give remarkable results in engine mount testing, particularly in endurance testing since it provides a visual means of determining the time of internal failure by the oscilloscope.

Timken-Detroit Axle Builds in Ohio

Construction has been started at Ashtabula, O. on a new Axle Brake Plant for the Timken-Detroit Axle Co., Detroit. The new building will contain 80,000 sq ft of floor space for the manufacture of Timken brakes and related parts. In addition to the latest in manufacturing equipment, the new plant will contain complete facilities for research and testing of Timken brakes.

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NEW SCIENTIFICALLY IMPROVED BLACOSOLV

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Now all metals or combinations of metals may be scientifically degreased with the same solvent. You need not pay premium prices for special solvents for different metals. The new, improved BLACOSOLV is the most highly stabilized degreasing solvent for use in solvent vapor degreasers. It can be used over and over again without impairing its high qualities. BLACOSOLV is non-inflammable... has a low boiling point (188° F.)... Does not affect or stain even the most highly polished surfaces.

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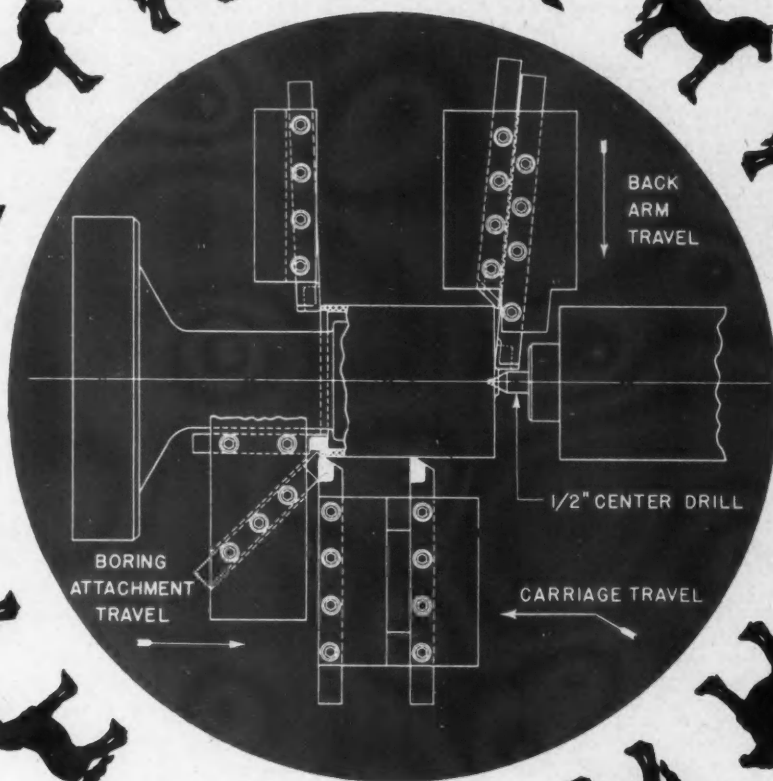
BLACOSOLV
DEGREASERS AND SOLVENT

NIAGARA
METAL PARTS WASHERS

How much HORSEPOWER are You using

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1st. Operation on
an Aluminum Auto-
mobile Piston:—
Rough turn O.D.
Face head and skirt ends
Center closed end
Rough bore skirt
Finish bore skirt
Chamfer skirt



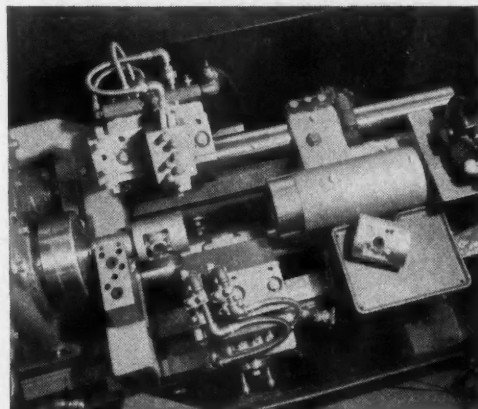
This operation, on an aluminum automobile piston, is accomplished in **15 seconds** on a 12" Fay Automatic Lathe using carbide cutting tools. **15 HORSEPOWER** is required. The surface speed used is **1250 FPM**.

Carbide cutting tools have increased horsepower requirements as much as 300 per cent. They have increased cutting speeds 200 to 500 per cent.

Be skeptical of the production efficiency of your metal turning equipment. The chances are that turning accounts for 25 per cent or more of all machining time in your plant—that this is your major production expense.

There are cases in our files of savings of hundreds of dollars a month in the manufacture of a single part by the efficient use of carbide cutting tools on Jones & Lamson machines. Our Turret Lathes and Fay Automatic Lathes are designed specifically for the most efficient use of these tools.

Send for our folder "Machining Automotive Pistons". Or better yet, telephone or write for a Jones & Lamson engineer who will be glad to consult with you on all phases of your metal turning problems.



JONES & LAMSON MACHINE COMPANY, Springfield, Vermont, U. S. A.

Manufacturer of *Fay Automatic Lathes*

and Universal Turret Lathes •

Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers • Ground Thread Flat Rolling Dies

May 1, 1947

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**Pleases Ohio Cities
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Ohio, famed state of thousands of great industries and many prosperous and progressive cities now has in operation over 650 Layne high efficiency Well Water Systems. These Vertical Turbine systems are distinguished by their outstanding engineering features, extraordinarily high quality and absolute dependability in providing years and years of service.

Layne Well Water Systems are world famous for low operation cost. Furthermore they are so sturdily built and correctly installed that little or no upkeep expense is necessary.

For nearly 70 years Layne has pioneered in Well Water Systems and Vertical Turbine Pumps. No other make, in all the world compares with their high standards of perfection.

For further facts, catalogs, bulletins, etc., address LAYNE & BOWLER, INC., General Offices, Memphis 8, Tennessee.

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Wells—Lakes—Rivers—Reservoirs—Irrigation Projects—are obtainable in sizes from 40 to 16,000 gallons per minute, powered by electric motor, V-belt or angle gear drives. Write for Pump Catalog.

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WELL WATER SYSTEMS VERTICAL TURBINE PUMPS

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New Production and Plant **EQUIPMENT**

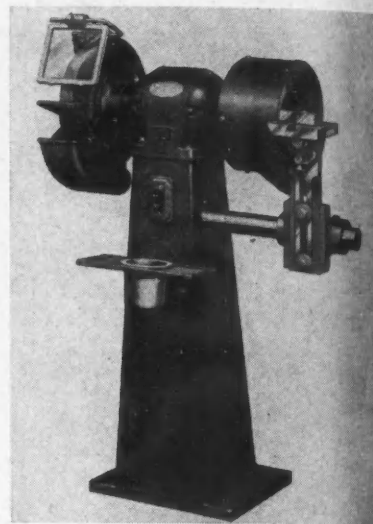
(Continued from page 52)

to desired angles and to height and wheel wear.

The grinder is equipped with eye shield, tool tray, water pot, and guards with exhaust connections. Slope front is designed for maximum foot clearance.

The motor—220-440, 550 volts, 2 or 3 phase, 50 or 60 cycle—is totally enclosed to N.E.M.A. specifications.

Through a typographical error, an illustration of a gear shaving machine made by the National Broach & Machine Co., Detroit, Mich., was incorrectly identified in the March 1 issue of AUTOMOTIVE AND AVIATION INDUSTRIES. The correct name of this well known piece of equipment is the Red Ring Model GCS Turmatic gear shaving machine.



Model 260 carbide tool grinder

AUTOMOTIVE

and

AVIATION

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Goes into

Leading

Plants in the

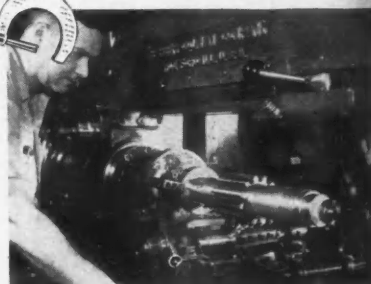
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Industries



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Truly fine gears are the product of manufacturing skill and fine equipment. Fairfield offers both—over 25 years of fine gear-making experience and batteries of modern gear-making machines. Here are complete facilities for making fine gears to order with each operation under the supervision of a skilled craftsman.

Let us go over your gear problems with you. Write for complete information on what Fairfield can do for you. Fairfield Manufacturing Co., 319 South Earl Avenue, Lafayette, Indiana.

Here are a few of the industries for which Fairfield supplies fine gears made to order

Automotive • Construction Machinery • Agricultural Machinery
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Machinery • Marine Equipment • Pumps and Winches • Transportation

FAIRFIELD

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AIR TOOLS

*do the job Faster
with Less Fatigue*

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Model 7000 Screw Driver

● There's a job-engineered Air Tool by ARO for a wide range of assembly work . . . screw-driving, nut-setting, drilling, grinding and similar operations. These tools give a real lift to production—they're speedy, powerful, light-in-weight, and thoroughly dependable. Precision-built to do the job better and faster . . . with trouble-free performance! Write for catalog. See your ARO Jobber. The Aro Equipment Corp., Bryan, Ohio.

by **ARO**

May 1, 1947

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77

New Pressure Indicator Design

(Continued from page 39)

tained with Mini-Max No. 455 batteries for the B supply and size D flashlight cells for the tube filaments.

The Dumont 208-B oscilloscope was selected because of the high gain and low frequency response of its amplifiers. A Dumont type 5LP11 cathode-ray tube is used for photographic purposes. Single-cycle indicator diagrams can be photographed conveniently with high-speed panchromatic film in any camera having an F/3.5 lens.

A combination spark-plug and pres-

sure indicator has one distinct advantage over more conventional indicators in that it requires no additional opening in the combustion chamber. Pressure-time or pressure-volume relationships can be obtained on any stock engine merely by substituting the combination spark plug and pressure indicator for the regular spark plug. Since the spark-plug part of the combination is of conventional design, the pressure data is obtained for standard combustion conditions. The indicator is par-

ticularly useful in studying the effect of combustion chamber design where the introduction of an additional opening for a pressure indicator adds another variable. It is also useful in comparing pressure data from various cylinders of the same or different engines.

Ease of installation of the pickup in stock engines and low power requirements of the auxiliary apparatus make the instrument convenient for road tests of stock automobiles. For this purpose the oscilloscope can be powered from a 6-v d-c to 110-v a-c inverter. A synchronized sine-wave generator may be used as a volume sweep for P-V diagrams, or the engine spark may be used to synchronize the time sweep for P-T diagrams. Fig. 3 shows some pressure-time and pressure-volume diagrams obtained with a 1946 six-cylinder Ford engine equipped with a 7.5 to 1 compression ratio head. The P-T diagrams were obtained by using the sweep circuit of the oscilloscope, while the P-V were obtained by driving a sine-wave generator from the engine crankshaft. Thus the latter are not true P-V curves because the piston displacement curves are not sine-waves. These diagrams show the range and sensitivity of the instrument and its freedom from spark interference.



BUT...

Airborne transportation of this decade has relegated obsolete aircraft to museum rooms. As the science of aeronautics has progressed, so has flight performance advanced in simplicity and efficiency.

Alodine*

a product of the American Chemical Paint Company, has assumed a comparable position in the field of aluminum rust-proofing and paint-bonding.

Alodizing with "Alodine" is a simple, rapid and effective chemical treatment for aluminum and its alloys. It requires no special skills, no current and therefore, no expensive electrolytic equipment. A highly protective coating is formed in less than three minutes and at practically room temperature, while comparable coatings produced by other methods require an hour or more for their formation.

ALODINE seals as it coats and prepares aluminum for exceptional corrosion resistance and excellent paint adhesion in a minimum of time and with a minimum of equipment.

* Trade Mark Reg. U. S. Pat. Off.

RUST PROOFING AND PAINT BONDING

Granadine
Duridine
Alodine
Lithoform

RUST REMOVING AND PREVENTING

Deoxidine
Peraline

PICKLING ACID INHIBITORS

Rodine

AMERICAN CHEMICAL PAINT CO.
AMBLER PENNA.

Ford Installs New Phosphating Tunnels

The Ford Motor Co. has recently extended its phosphate treatment of sheet steel body parts to include complete bodies of both Ford and Mercury cars. This has involved the installation of two new tunnels, each equipped for the latest type of spray treatment. The treatment is done on a continuous basis as the bodies are advanced by the same overhead chain that brings them from body assembly lines and subsequently carries them through painting operations. On the Ford line, bodies are treated at the rate of one per min; and on the Mercury line, one every two min. All surfaces of the body shell, both interior and exterior, are subjected to the phosphate spray. Ford states that such bodies treated with phosphate yield far longer service without signs of rusting.

Weight Distribution in a 41-passenger 1947 Mack City Bus (Empty)

	Weight 13,350 lb wet	Per Cent
Front axle assembly.....	10.5	10.5
Rear axle assembly.....	16.9	16.9
Powerplant (engine and trans.).....	16.4	16.4
Body framing and panels.....	16.0	16.0
Chassis framing.....	5.3	5.3
Seats.....	5.5	5.5
Gas (100 gal.), water and oil.....	2.7	2.7
Heating and ventilation.....	2.7	2.7
Side window sash and glass.....	2.0	2.0
Floor and floor covering.....	2.2	2.2
Doors and control.....	0.9	0.9
Cooling system (radiator, shutter, hoses).....	12.5	12.5
Misc. as paint, insulation, nuts, bolts, rivets.....	100.0	100.0

This is a LEATHER PACKING

Like all Sirvis packings it was engineered from the unblemished center portion of the finest steer hides. Selected, treated and molded under strict laboratory control, Sirvis packings can be used to seal oil, water, air or other fluids and gases under various pressures and temperatures. Correct in design, tannage, and degree of hardness or flexibility, they will give long, rugged service. For maximum assurance of such accuracy, dependability and perfect performance, when you need leather packings, always order *Sirvis*.

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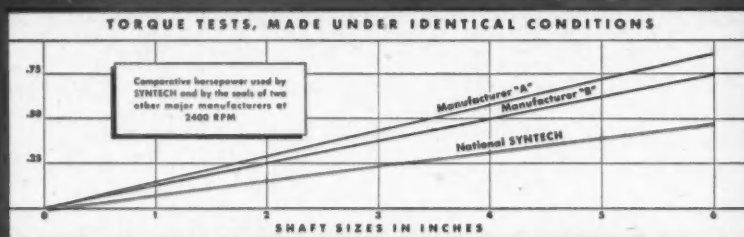
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	Per Cent
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....	16.4
....	16.0
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....	5.5
....	5.5
....	2.7
....	2.7
....	2.2
....	2.3
....	0.9
....	12.5
....	100.0

DUSTRIES

Syntech^{*}

**New National Oil Seal
shatters all records in
performance... Gives
100% longer life, 70%
less drag, zero leakage**

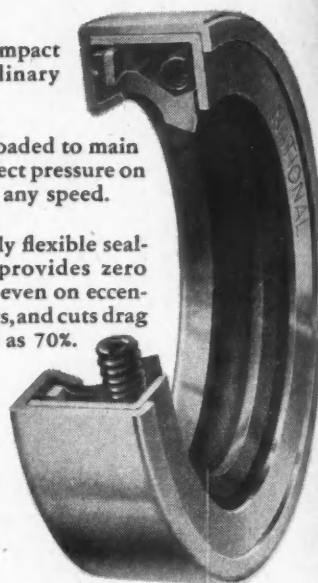


Arduous road and dynamometer tests prove positively that the new National SYNTECH Oil Seal is head and shoulders above the field. Safety and economy factors of abrasion, wear, speed and runout far exceed those found in any other seals tested. Optimum results are obtained and marked reduction in power wastage is made possible by lower torque. And tests conclusively show that National SYNTECHS performed at zero leakage over periods up to 10 times the life of a normal application. This effectively blasts the theory that a seal must allow seepage to achieve long life.

Get in touch with National today—for more information and samples of the amazing new SYNTECH. National SYNTECHS are available in any size, for any operation. They represent a great engineering triumph in the field of lubricant retention.

SYNTECH (trademark registered) is an entirely new oil seal which utilizes a special National-developed, synthetic-rubber sealing member.

- 1 More compact than ordinary oil seals.
- 2 Spring-loaded to maintain correct pressure on shafts at any speed.
- 3 Extremely flexible sealing lip provides zero leakage, even on eccentric shafts, and cuts drag as much as 70%.

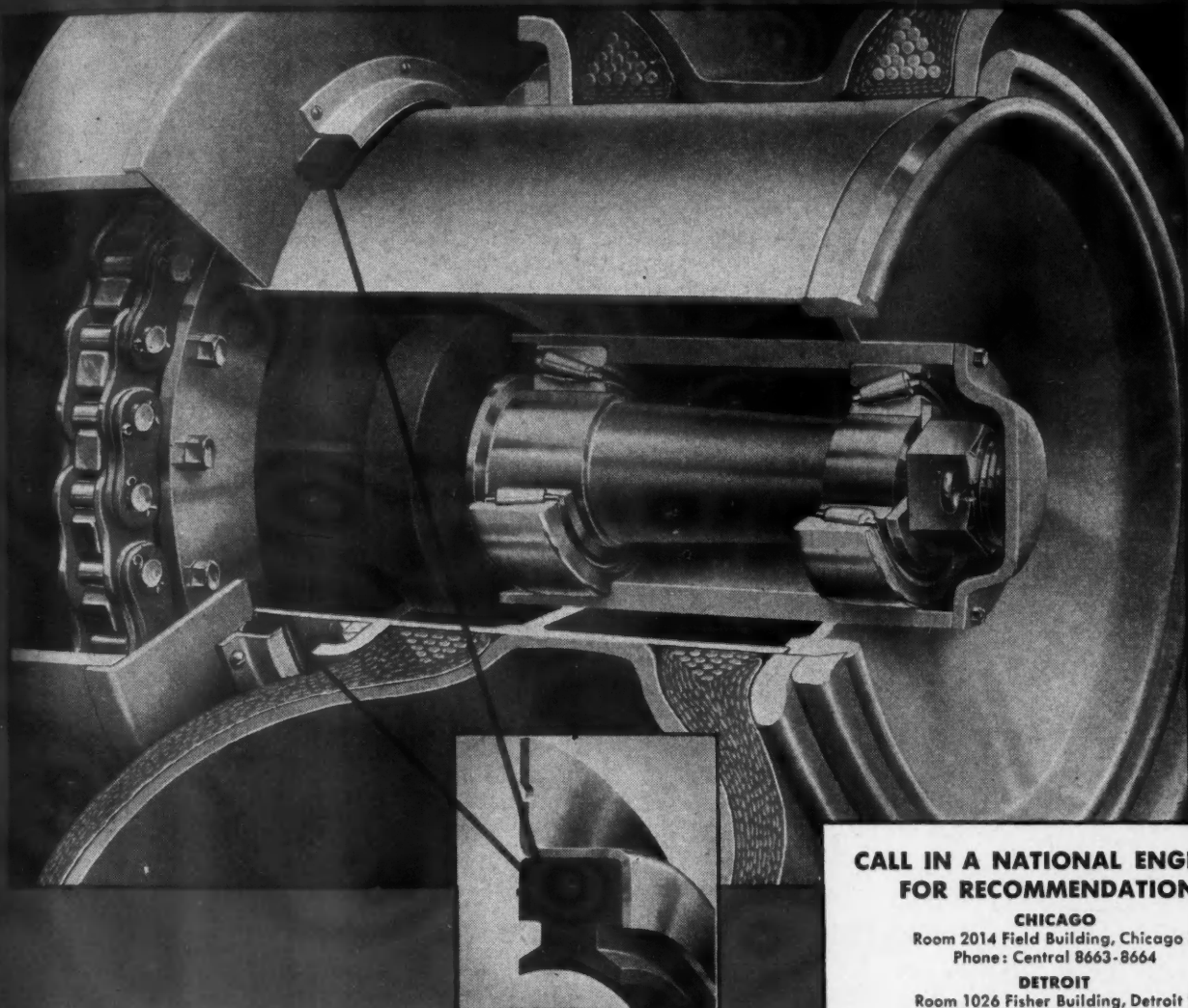


SYNTECH is made of synthetic rubber compounded to achieve high flexibility and low coefficient of friction.

Design of sealing lip provides limited shaft contact.

This thin section assures maximum flexibility of the sealing member.





A special 28" O. D. Syntech seal does the ideal job on this scraper's power take-off

A leading road machinery manufacturer recently brought us one of the toughest problems we've ever solved. He needed a rugged, long-lasting seal with a relatively monstrous O.D. His application was the power-drive housing of his heaviest road scraper, where mud, dust and rocks hand out a terrific daily beating to any oil retainer.

National engineers custom-designed a National SYNTECH Oil Seal capable of withstanding the hard knocks received by this

equipment. Measuring just over 28" in diameter, this specially-designed SYNTECH permitted the scraper to turn in months of continuous performance. Not a day was lost by breakdown attributable to oil seal failure.

On-the-job performance like this demands respect. Let National engineers assist you with your problem. Give us the complete details so we can be of maximum help. Your application will be kept in strictest confidence.

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WHEREVER SHAFTS MOVE, THERE'S A
NATIONAL SEAL TO RETAIN THE LUBRICANT

NATIONAL MOTOR BEARING COMPANY, INC.

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Plants: Redwood City and Los Angeles, California; Van Wert, Ohio

May 1, 1947

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81

Lear Solves Short Run

(Continued from page 41)

more favorable and competitive cost structure.

In many instances the engineering department is prepared to modify the design of a part if this will serve to utilize existing equipment. Obviously, this partnership of engineering and production can be made an invaluable tool in cost reduction. In a setup of this kind the production department becomes an actual adjunct of engineering and can devote its energies to short cut

production methods and simplification of the methods employed in making standard parts. This plan has resulted in an extremely simple and flexible machine shop facility, concentrated in a small area. In addition to the machine shop they have a small but complete heat treating department, an electroplating section, and a compact press shop featuring a variety of presses suitable for making small stampings as well as cabinets and chassis for the

radio division. Among the press shop equipment is a Henry & Wright dieing machine set up primarily for producing laminations. Incidentally, by virtue of larger runs stemming from standardization, many of the small presses are fitted with progressive dies in the interest of speeding productivity.

Owing to its simplicity, it is feasible to visualize the machine shop setup by considering two typical but dissimilar parts—the Model 164 gear housing, used on many of the assemblies, and the pinion and shaft gear cluster which enters into the assembly. Let us examine the cluster gear first. The pinion has eight teeth of 48/60 DP with a pressure angle of 20 deg and basic pitch diameter of 0.1667 in. The gear has 100 teeth of 72 DP with a basic pitch diameter of 1.3889 in. The face of the gear is specified perpendicular to the shaft within 0.001 in. full indicator reading, while the principal diameters of the shaft, gear, and pinion are held concentric within 0.001 in. full indicator reading. This part is rough blanked in No. 3 Warner & Swasey turret lathes, then pre-hardened. Succeeding operations are as follows:

OPERATION AND MACHINE

Face and turn, Face, undercut and center Turn—South Bend Lathe.
Grind—Brown & Sharpe External Grinder.
Hob teeth—Barber-Colman Hobber.
Shape gear, Shape pinion—Fellows High Speed Gear Shaper.
Wash and degrease—Detrex Degreaser.
Case harden—Lindberg Furnace.
Burr gear, Tampico brush, and Lap.
Grind—Brown & Sharpe External Grinder.
Inspect and oil dip.

The gear housing is made in two halves of aluminum alloy sand castings, the individual halves being processed separately through the initial milling, drilling, and precision boring operations, then assembled in pairs for the succeeding operations—boring, milling, drilling, etc.—as an integral housing.

One of the major items of equipment in the machine shop is a battery of single- and double-spindle single-end Heald Bore-Matics, used for all finish boring operations and a few facing operations. Brown & Sharpe vertical and horizontal milling machines handle all milling operations. Milling machines and the Heald Bore-Matics are centralized in one area of the shop. Another area houses a battery of small Brown & Sharpe automatics and a group of the familiar Warner & Swasey turret lathes. Another section of the shop is concerned with drill press operations and tapping. Here will be found a sizable battery of Leland-Gifford and Buffalo drill presses of multiple spindle type. Gear cutting is done on Barber-Colman and Fellows equipment.

In addition to the basic equipment mentioned above, there is a two-spindle Landis Threadmatic and a Jones & Lamson thread grinder, both being flexible items capable of quick change-



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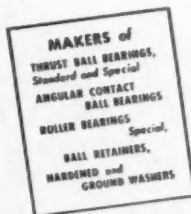
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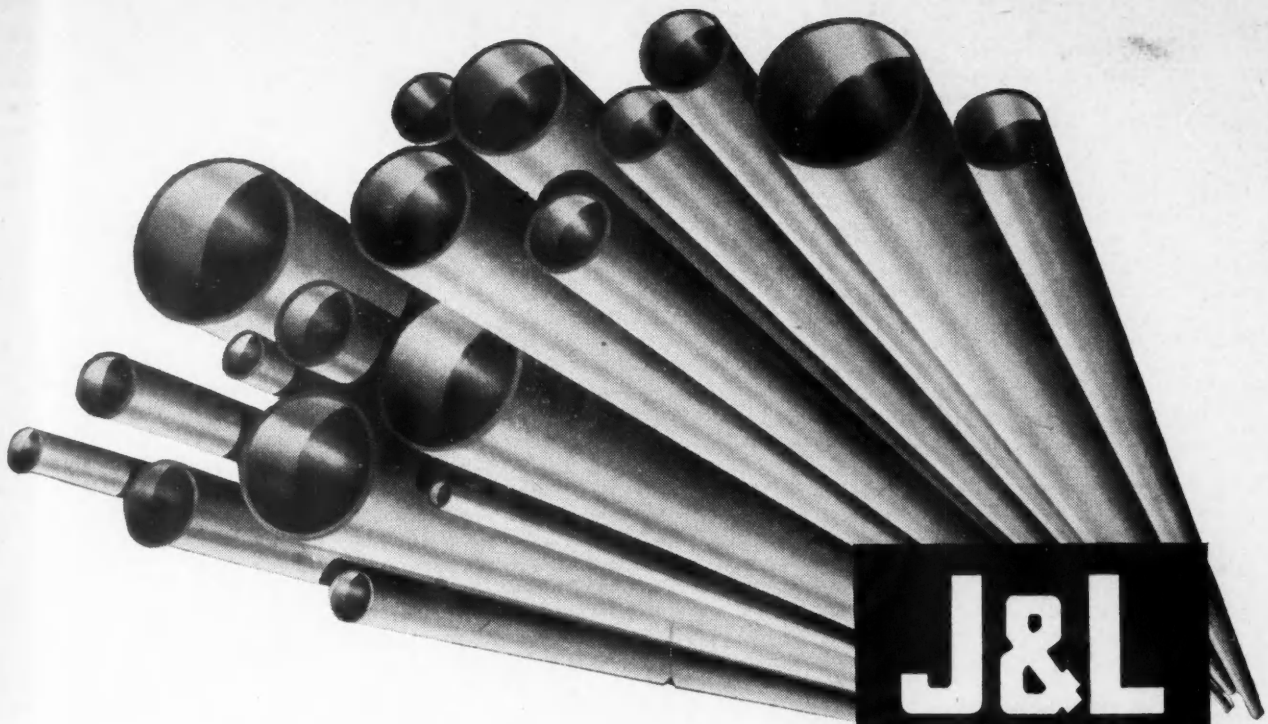
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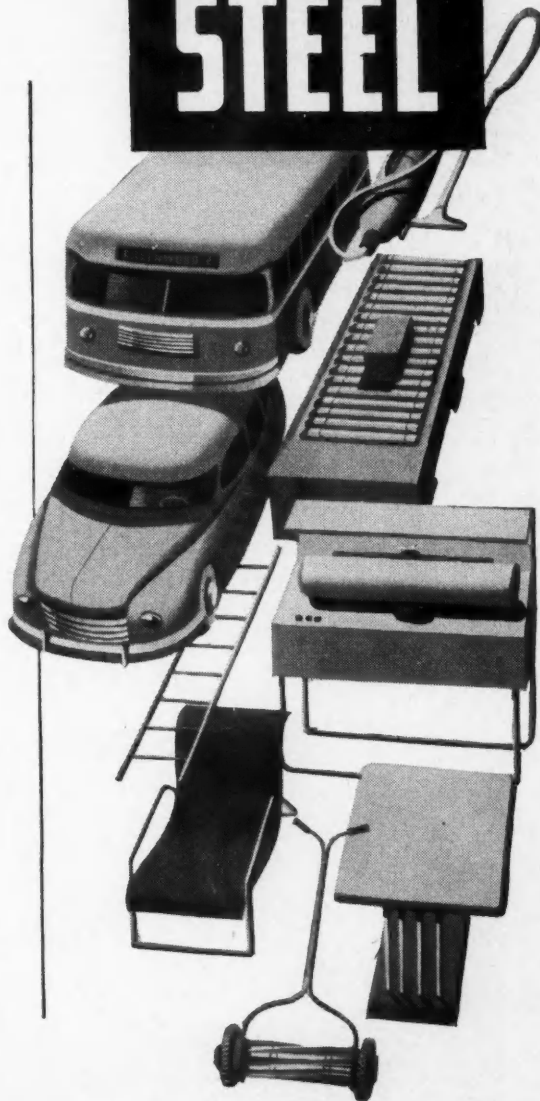
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For forming operations, the uniformity of cross-section and wall thickness of Electricweld Tubing makes it possible for products to conform to close tolerance limits. Electricweld Tubing can be altered in cross-section by any number of processes to meet requirements of design. It bends easily in all directions and can be readily joined by mechanical or welding methods.

Beauty and sales appeal in finished products are aided by the smooth, uniform surface of J&L Electricweld Tubing. It provides an ideal base for electro-plating, enameling, and painting. These finishes can be applied with a minimum of surface preparation.

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over for runs of any size. Too, they have a Van Norman high frequency unit for annealing, brazing, and hardening operations on small parts. The familiar Magnaflex method inspection machine is used for checking of stressed parts.

Final assembly marks another phase of this interesting operation. Assembly is done on long benches, each equipped to handle a family of parts. For example, one bench takes the assembly of screw jacks and linear actuators; another, the rotary type actuators. The tiny motors are built up from component parts in a small bay fitted with sub-assembly benches and suitable

equipment for the various stages of assembly, terminating finally at the motor assembly line. Still another bench group takes care of wiring and the installation of switches.

As one would naturally expect, a highly technical product of this kind depends to a great extent upon research and development. And, at Lear, engineering research constitutes easily the most extensive activity in the plant. Engineering responsibility covers the development of new products, improvement of existing products, study of new applications, life testing of parts and assemblies, and fundamental research.

One of the secrets of the success of

this organization in its specialty is found in metallurgical research. Consider that these relatively small units, powered by tiny motors, are capable of almost prodigious energy and endowed with unusual longevity. For their size, the Lear units carry enormous loads and are capable of withstanding high unit bearing pressures. Moreover, the tiny gears also are capable of handling relatively high loading.

Metallurgical research has been responsible for the selection of special materials and alloys suited to the application; and the development of heat treating techniques of unique character. For one thing, heat treating is done in stages, depending upon the nature of the part. A specific example of this practice is found in the routing of the cluster gear described earlier which has a pre-hardening stage immediately following the roughing of the blank. Process specifications are designed to develop high physical properties through a proper control of core hardness in small diameters, which is no small undertaking, and to yield durability through proper surface hardness.

Combination of these controls permits the manufacture of extremely small and lightweight units possessing high load-carrying ability and long service life.

In the pictorial section we have reproduced illustrations showing a grouping of families of Lear products to show the principle of interchangeability emphasized in this article. Combinations of standard units, changes in gear ratio, variations in motor size, and the addition of special accessories make possible an endless chain of control devices adaptable to applications of amazing variety.

Torsion Rod Suspension

(Continued from page 27)

the torque rod stresses were reduced about 25 per cent.

A speed of 15 mph over a rough dirt road with 12 lb of air in the tires was assumed as a conservative design condition. As the maximum shear stress of 22,760 psi was encountered only once in three seconds at 15 mph over the dirt road, this stress would presumably be repeated no more than 200,000 times in 2500 miles of such a road. It is believed that 2500 miles of driving over the rough dirt road would represent a service life of 16 years. As it would be possible for a driver to suddenly find himself in a bad road at a speed higher than 15 mph, it was deemed necessary to design the suspension system to withstand 100 repetitions of 33,000 psi which would correspond to running into a bad stretch of road at 35 mph six times per year; this would also correspond to 16 years of service.

(This study was made possible by C. W. Worman, president, and Dan Pocapalia, vice-president, production, Kit Manufacturing Co., Norwalk, Calif.)

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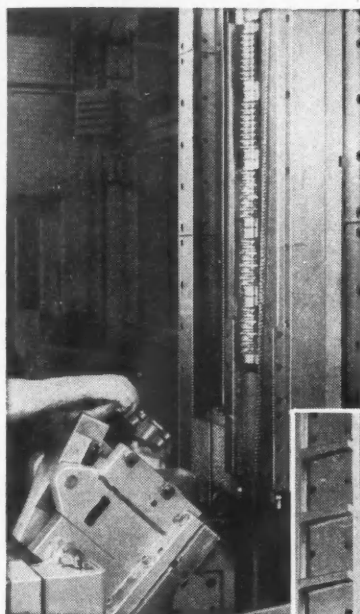
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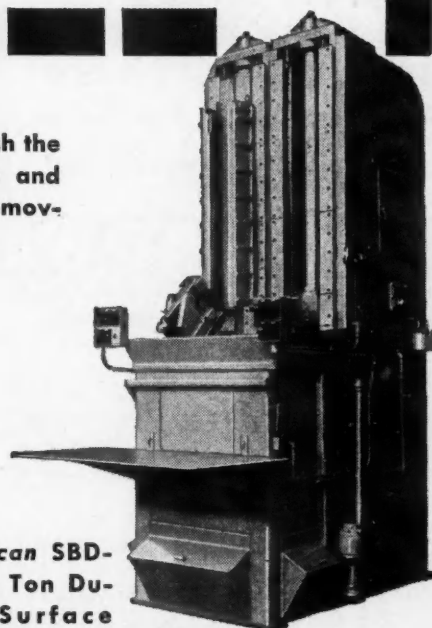
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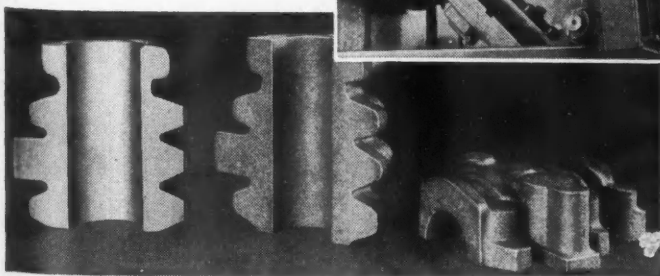
Operation at the left is to finish the joint face and bearing lock and semi-finish the half round, removing $\frac{1}{8}$ stock on each surface.



Operation at right straddle broaches the two ends of the casting.



American SBD-66-25 Ton Duplex Surface Broaching Machine with tilting type work tables.



Above: Right to left: 1. The rough casting. 2. Ends straddle broached. 3. Joint face, bearing lock and half round broached.

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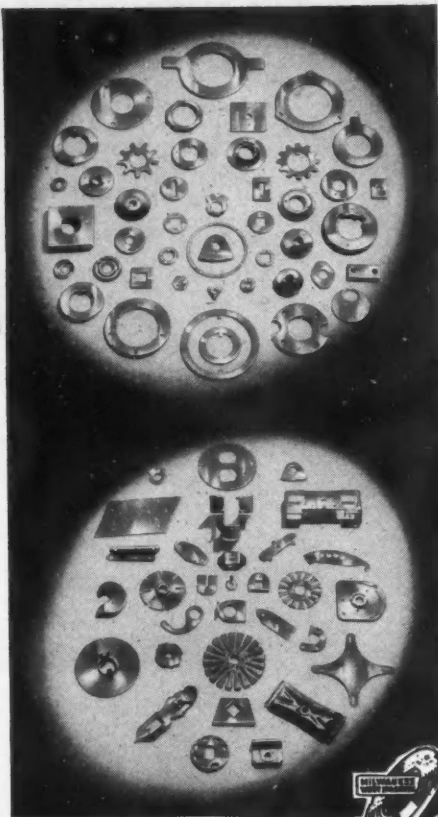
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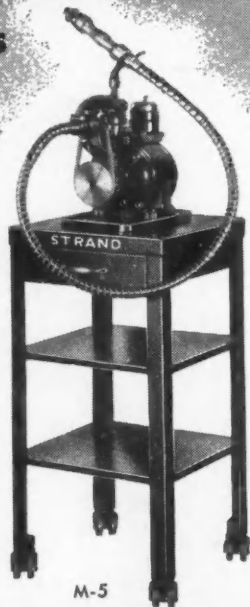
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New GM Reverse Gear

(Continued from page 36)

models. Direct drive hydraulic marine gears are made up of three functional units:

- A. A control valve actuated by a small lever which regulates the flow of oil into the gear box.
- B. A flywheel assembly made up of a clutch disc which is splined to the drive shaft and positioned between a forward reaction plate and piston plate. This constitutes the entire forward driving mechanism.
- C. A reverse gear aft of the forward drive and consisting of a ring of planetary gears for accomplishing reverse rotation together with a stationary reaction plate and second clutch which engages the planetary system.

In operation, both the direct drive and reduction gear types function in essentially the same manner, except that in the direct drive unit oil is supplied from the engine oil pan whereas with reduction gears the oil supply is carried in the reduction gear housing. A positive displacement pump mounted on the flywheel housing and driven by the engine supplies oil at the proper pressure for operation of the clutch engaging mechanism.

Oil is admitted to the gear box through three grooved passages, one for forward speed, one for reverse speed, and one for lubrication of those parts not subject to splash lubrication. The lubricating passage is never cut off regardless of the position of the control valve.

With the control valve lever in the forward position, oil under pressure is admitted behind the forward piston plate moving the plate so as to grip the clutch disc between itself and the reaction plate, thus causing the clutch and the drive shaft to turn in the direction of engine rotation.

When the control lever is moved back through neutral into the reverse position, oil is directed against a second piston plate which locks the reverse clutch disc against the stationary reaction plate. Since the outer ring of the planetary system is splined to the clutch plate, it too is locked in a stationary position when the clutch is engaged. The planet gears are bearing mounted on a carrier which in turn meshes with the drive shaft. The sun gear of the planetary train turns in the direction of rotation of engine so that when the outer ring gear is held tight, planet gears are free to "walk around" rotating the carrier and the drive shaft in the opposite direction.

In neutral position, the control valve cuts off the flow of oil under pressure to the piston plates so that both clutches are allowed to run free and the shaft does not turn.